

LINDA LINGLE
GOVERNOR OF HAWAII

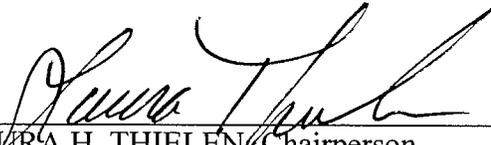


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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809
JUN 10 2010

Dear Parties:

Attached is the Commission's Findings of Fact, Conclusions of Law, and Decision and Order in the matter of the `Iao Ground Water Management Area High-Level Source Water-Use Permit Applications and Petition to Amend Interim Instream Flow Standards of Waihe'e River and Waiehu, `Iao, & Waikapū Streams Contested Case Hearing (CCH-MA06-01).



LAURA H. THIELEN, Chairperson



WILLIAM D. BALFOUR, JR., Commissioner

SUMNER ERDMAN, Commissioner

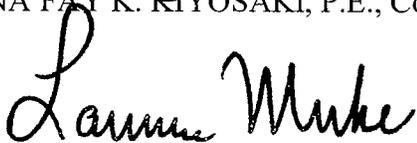
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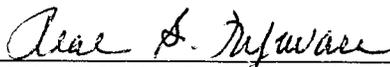
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COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII

ʻIao Ground Water Management Area)	Case No. CCH-MA06-01
High-Level Source Water-Use)	
Permit Applications and)	FINDINGS OF FACT, CONCLUSIONS
Petition to Amend Interim Instream)	OF LAW, AND DECISION AND ORDER
Flow Standards of Waihe`e River)	
And Waiehu, ʻIao, & Waikapū)	
<u>Streams Contested Case Hearing)</u>	

**FINDINGS OF FACT, CONCLUSIONS OF LAW, AND
DECISION AND ORDER**

I hereby certify that the foregoing
is a true and correct photocopy of the
original document on file in the office of the
Commission on Water Resource Management.

Dated JUN 10 2010 By *W. Roy Hardy*
W. ROY HARDY, Hydrologic Program Manager
for KEN C. KAWAHARA, P.E., Deputy Director

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Dissenting Opinion of the Hearings Officer/Commissioner Lawrence H. Miike 1

1 **Commission on Water Resource Management**

2
3 **FINDINGS OF FACT, CONCLUSIONS OF**

4
5 **LAW, AND DECISION AND ORDER**

6
7 For nearly 150 years, the waters of Nā Wai `Ehā—Waihe`e River, North and South
8 Waiehu, `Īao, and Waikapū Streams—have been diverted, primarily to irrigate sugar cane but
9 also for kuleana lands, other agricultural purposes, and domestic uses. Under the prevailing laws
10 at the time when the ditch systems were built and sugar was the dominant industry, water was
11 treated as private property and streams were diverted to such an extent that practically all of their
12 dry-weather flows were diverted. Following statehood and a state court system whose judges and
13 justices were not federally appointed as in the days when Hawai`i was a territory, in 1973 the
14 Hawai`i Supreme Court ruled that title to water was not intended to be and was not transferred to
15 an awardee by the Great Mahele, and that water in streams and rivers (and all freshwater
16 resources, including underground aquifers) were held in trust by the state for the common good
17 of its citizens. The constitutional amendments of 1978 and the State Water Code of 1987 further
18 confirmed and solidified that the freshwater resources of the state were held in trust for its
19 citizens.

20 This “public trust doctrine” embodies a dual purpose: 1) protection, and 2) maximum
21 reasonable and beneficial use. In short, the objective is not maximum consumptive use, but
22 rather the most equitable, reasonable, and beneficial allocation of state water resources, with full
23 recognition that protection also constitutes use.

24 The Court has identified four trust purposes: 1) maintenance of waters in their natural
25 state; 2) domestic water use of the general public; 3) Native Hawaiian and traditional and
26 customary rights, including kuleana water rights; and 4) reservations of water for Hawaiian home
27 lands. For those seeking private, commercial uses of water, there is a higher level of scrutiny. In
28 practical terms, this means that the burden ultimately lies with those seeking or approving such
29 uses to justify them in light of the purposes protected by the trust.

30 The Commission on Water Resource Management (hereinafter the “Commission”) is
31 statutorily charged with the responsibility to weigh competing public and private water uses on a
32 case-by-case basis, accommodating both instream and offstream uses where feasible, and must

1 consider the cumulative impact of existing and proposed diversions on trust purposes and to
2 implement reasonable measures to mitigate this impact, including using alternative resources.

3 This contested case hearing addresses a petition to restore flows to the Nā Wai `Ehā
4 streams, as well as applications for water use permits from the diked, high-level water enclosed
5 in the mountains above these streams, which is also the source of the headwaters of these four
6 streams. The applications for water use permits were a consequence of the designation of the `Īao
7 Aquifer System as a ground water management area, which includes basal, caprock, and high-
8 level dike sources. Applications for permits from the basal and caprock sources were previously
9 addressed by the Commission.

10 While this contested case hearing was being conducted, the Commission also designated
11 the four Nā Wai `Ehā streams as a surface water management area, with an effective date of
12 designation of April 30, 2008. Existing-use permits had to be filed within one year of the date of
13 designation, or by April 30, 2009. Applications for new-use permits may be filed at any time.
14 These permit applications can be accommodated only to the extent that stream waters for
15 offstream uses are available. The amount of stream water available for offstream uses is
16 determined in this contested case hearing, because the amended instream flow standards will
17 determine how much water must remain in Waihe`e River, North and South Waiehu Streams,
18 `Īao Stream, and Waikapū Stream, and those standards will in turn determine how much water
19 will be available for offstream uses.

20 The Commission makes the following Findings of Fact (hereinafter, “FOF”),
21 Conclusions of Law (hereinafter, “COL”), and Decision and Order (hereinafter, “D&O”), based
22 on the records maintained by the Commission and the witness testimonies and exhibits presented
23 and accepted into evidence.

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

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

1 I. FINDINGS OF FACT

2
3 A. BACKGROUND

4 1. On July 9, 2001, a petition was filed to designate the `Īao and Waihe`e Aquifer System
5 Areas as ground water management areas. Following numerous reviews, hearings, and meetings
6 and its Findings of Fact, the Commission denied immediate designation but imposed triggers to
7 automatically cause designation. One of these triggers was pumping greater than 90 percent of
8 the aquifer’s sustainable yield, based on a 12-month moving average (hereinafter, “12-MAV”).

9 2. In June 2003, the 12-MAV for the `Īao Aquifer System Area exceeded the Commission’s
10 designated trigger, and on July 21, 2003, `Īao was officially designated a Ground Water
11 Management Area upon publication of the public notice declaring designation and describing the
12 water management area regulations. Ground water in the `Īao Aquifer System includes basal,
13 caprock, and high-level dike sources.

14 3. On June 25, 2004, Hui o Nā Wai `Ehā and Maui Tomorrow Foundation, Inc. (hereinafter,
15 “Hui/MTF”), through Earthjustice, filed a “Petition to Amend the Interim Instream Flow
16 Standards for Waihe`e, North & South Waiehu, `Īao, and Waikapū Streams and Their
17 Tributaries.”

18 4. By July 21, 2004, some existing users had not met the one-year deadline for filing water
19 use permit applications (hereinafter, “WUPAs”), and all WUPAs were the subject of objections.
20 On September 22, 2004, the Commission authorized a subcommittee to convene a public hearing
21 on Maui to hear objections to and clarifications of the WUPAs. Existing and new-use WUPAs
22 were to be addressed in separate sessions but on the same day, and the public hearing was to
23 remain open to allow the public time to request a contested case hearing. Commissioners James
24 Frazier and Lawrence Miike were appointed to the subcommittee.

25 5. On October 19, 2004, Hui/MTF, who had filed the June 25, 2004, petition to amend the
26 interim instream flow standards (hereinafter, “IIFS”) for Waihe`e, North & South Waiehu, `Īao
27 and Waikapū Streams and their tributaries, also filed a Waste Complaint and a Petition for
28 Declaratory Order against Wailuku Water Company (“hereinafter, “WWC”), then known as
29 Wailuku Agribusiness Co., Inc., and Hawaiian Commercial & Sugar Company (hereinafter,
30 “HC&S”).

31 6. On October 28, 2004, the subcommittee conducted the first session of the public hearing.

1 7. On April 22, 2005, a second session of the public hearing was held on Maui. The hearing
2 remained open for subsequent information-gathering. On July 11, 2005, an information-sharing
3 meeting was held on Maui by Commission staff, where the parties attending reported on
4 meetings between themselves to resolve some issues to avoid a possible contested case hearing.

5 8. On September 7, 2005, the next session of the public hearing was held on Maui. This
6 session was limited to basal and caprock wells, and it was announced that the public hearing
7 would be closed at the end of the meeting for these wells. Prior to the close of the hearing,
8 several requests were made for a contested case hearing (hereinafter, "CCH") concerning various
9 basal well sources, and timely written requests were submitted by two applicants, Maui
10 Department of Water Supply (hereinafter, "MDWS") and Kehalani Mauka (hereinafter, "KM"),
11 and three organizations: Hui o Nā Wai `Ehā and Maui Meadows Association, both represented
12 by Earthjustice, and the Office of Hawaiian Affairs (hereinafter, "OHA"). MDWS requested a
13 CCH for all eight of its WUPAs and for KM's competing application for the Shaft 33 battery of
14 wells; KM requested a CCH for its and MDWS's competing application for the Shaft 33 battery
15 of wells; and Hui o Nā Wai `Ehā/Maui Meadows Association and OHA requested a CCH for all
16 eight of MDWS's WUPAs.

17 9. On October 5, 2005, Commissioner Lawrence Miike was appointed the hearings officer.

18 10. On October 17, 2005, standing was granted to all five requesting parties. On December
19 16, 2005, Hui o Nā Wai `Ehā/Maui Meadows Association and OHA withdrew their objections
20 and request for a CCH regarding MDWS's WUPAs, stating that they had reached a resolution
21 with MDWS. MDWS's request for a contested case on all eight of its WUPAs had been
22 conditioned on another party requesting a CCH, leaving only the competing applications for
23 Shaft 33 between MDWS and KM as the subject of the CCH.

24 11. On April 7, 2006, KM filed a motion for declaratory ruling that its application for Shaft
25 33 was for an existing use.

26 12. On April 19, 2006, the CCH was held on Maui, at which time the hearings officer also
27 heard and denied KM's motion for declaratory ruling.

28 13. Closing oral arguments were held on May 24, 2006, in Honolulu, and Proposed Findings
29 of Fact, Conclusions of Law, and Decision and Order were submitted to the hearings officer on
30 July 28, 2006.

1 14. The hearings officer issued his proposed Decision and Order on August 11, 2006, and on
2 January 31, 2007, the Commission issued its final Decision and Order. MDWS was issued a
3 water use permit for 5.771 mgd under WUPA No. 702 from Wailuku Shaft 33, State Well No.
4 5330-05, and KM was issued a water use permit for 0.691 mgd under WUPA No. 707 from
5 Wailuku Shaft 33, State Well No. 5330-05. Under the Decision and Order, KM could apply for a
6 modification of its permit for: 1) a change in the quantity of water currently awarded if it deems
7 the amount insufficient to meet its reasonable and beneficial needs under actual use conditions;
8 and/or 2) the 1,060 units projected to be completed between 2011-2014 in whole or in part
9 within the four-year statutory window of use/nonuse. HRS§174C-57. The Commission also
10 recognized that KM was currently obtaining all of its water from MDWS and that they were in
11 negotiations for the continued use of Shaft 33 by MDWS. If the parties agree that MDWS will
12 continue to provide water to KM, the Water Code provides for the transfer of KM's permit for
13 0.691 mgd, in whole or in part to MDWS. HRS §§174C-59 and 174C-57(c). On February 8,
14 2007, MDWS filed a Motion for Reconsideration of the Commission's D&O. On March 21,
15 2007, the Commission denied the Motion.

16 15. The WUPAs from caprock sources were approved on October 25, 2005. The WUPAs
17 from the basal aquifer that were not the subject of the CCH between MDWS and KM (the other
18 seven MDWS WUPAs and a new-use application from the Living Waters Land Foundation)
19 were approved on February 15, 2006.

20 16. Diked, high-level well and tunnel sources were not part of the September 7, 2005,
21 hearing, and the public hearing remained open for those WUPAs. On February 2, 2006, the final
22 session of the public hearing for WUPAs from these sources was held on Maui. Prior to the close
23 of the hearing, verbal requests were made by various parties for a CCH on all WUPAs from
24 diked, high-level sources. Written requests were submitted by: 1) MDWS; 2) WWC; 3) HC&S;
25 4) OHA; 5) Hui/MTF; and 6) Ka Aha O Nā Wai `Ehā Ku Moku O Mauiloa.

26 17. The WUPAs that were the subject of the February 2, 2006, public hearing were: 1)
27 MDWS's Well No. 5332-05 (Kepaniwai Well) for 1.042 mgd; 2) MDWS's Well No. 5332-02
28 (Īao Tunnel [Kepaniwai]) for 1.359 mgd; 3) HC&S's Well No. 5330-02 (Īao Tunnel [Puako])
29 for 0.100 mgd; and 4) five wells for unknown amounts of water: WWC's Wells No. 5132-01
30 (Waikapū Tunnel 1), No. 5132-02 (Waikapū Tunnel 2), No. 5332-01 (Black Gorge Tunnel), No.
31 5333-01 (Īao Needle Tunnel 1), and No. 5333-02 (Īao Needle Tunnel 2). The WUPAs for

1 Waikapū Tunnels 1 and 2 were subsequently excluded, because they were not subject to the `Īao
2 ground water management area designation. Chumbley, WRT 10/29/07, p. 8; Chumbley, WST
3 11/19/07, p. 3. WWC FOF 802.

4 18. On February 15, 2006, the Commission initiated a CCH for the `Īao high-level WUPAs
5 and specified that the petition to amend the IIFS of the four streams would be included in the
6 CCH. The Commission further directed that mediation for the waste complaint be initiated prior
7 to the CCH. On March 17, 2006, the Commission clarified its intent by ordering that two CCHs
8 be held, one for the petition to amend the IIFS and the `Īao high-level WUPAs (CCH-MA06-01)
9 and a separate CCH for the waste complaint (CCH-MA06-02). On June 19, 2006, standing was
10 granted in these two CCHs to the same five parties: 1) MDWS; 2) WWC; 3) HC&S; 4) OHA;
11 and 5) Hui/MTF. Ka Aha O Nā Wai `Ehā Ku Moku O Mauiloa had not applied to be a party in
12 the CCH on the waste complaint and had withdrawn its request to be a party in the CCH on the
13 high-level WUPAs.

14 19. Commissioner Lawrence Miike was again appointed hearings officer for both CCHs.

15 20. Peter Adler was appointed the mediator for the waste complaint on June 28, 2006, and
16 mediation was held from August 21, 2006, through October 6, 2006. On October 11, 2006, Mr.
17 Adler reported to hearings officer Miike that no agreement was reached.

18 21. On February 20, 2007, Hui/MTF filed a motion and petition to disqualify Yvonne Izu,
19 Esq., former Deputy Director of the Commission, from representing HC&S in both contested
20 cases.

21 22. On April 5, 2007, Yvonne Izu voluntarily withdrew as counsel for HC&S in both
22 contested cases.

23 23. On May 14, 2007, Hui/MTF withdrew its waste complaint and on May 31, 2007, CCH-
24 MA06-02 was dismissed without prejudice.

25 24. On June 14, 2007, a prehearing conference was held for CCH-MA06-01 (IIFS/permit
26 applications), at which a schedule for filing of documents was established, with the contested
27 case to begin on December 3, 2007.

28 25. The contested case evidentiary hearing was held on Maui over 23 days, commencing on
29 December 3, 2007, and concluding on March 4, 2008. Due to the large volume of transcripts that
30 had to be prepared and then made available to and reviewed by the parties, the deadline for the

1 parties' proposed Findings of Fact, Conclusions of Law, and Decision and Order was established
2 as September 26, 2008.

3 26. On March 13, 2008, the Commission designated the four streams of Nā Wai `Ehā as a
4 surface water management area. The effective date of designation was April 30, 2008, when the
5 Public Notice was published. Applications for existing-use permits had to be filed within a
6 period of one year from the effective date of designation, or no later than April 30, 2009.

7 27. On July 18, 2008, HC&S filed a motion to reopen evidence and offer of proof of a study
8 that HC&S had commissioned but which had not been completed at the time the evidentiary
9 hearings were concluded on March 4, 2008. On July 25, 2008, WWC filed a memorandum in
10 support of HC&S's motion; and on August 19, 2008, memoranda in opposition were filed by
11 Hui/MTF, OHA, and MDWS.

12 28. On August 21, 2008, a hearing on HC&S's motion to reopen the evidence and offer of
13 proof was held, at which time the motion was approved. The September 26, 2008, deadline for
14 the parties to submit their proposed Findings of Fact, Conclusions of Law, and Decision and
15 Order was also vacated.

16 29. On August 25, 2008, OHA filed a motion to supplement the record with a portion of the
17 Environmental Impact Statement Preparation Notice for the Proposed Wai`ale Water Treatment
18 Facility that was published in the Office of Environmental Quality Control's Environmental
19 Notice on July 8, 2008.

20 30. On October 14, 2008, the hearing on HC&S's study and on OHA's motion to supplement
21 the record was held on Oahu, with video connection to Maui with the consent of all the parties.
22 The hearing concluded with an evening session on the same day, with telephone connection to
23 Maui, again with the consent of all parties. At the hearing, the exhibit that was the subject of
24 OHA's motion to supplement the record, and an additional exhibit offered by OHA, were entered
25 into evidence on the stipulation of all parties. By the end of the evidentiary phase of the hearing,
26 the testimony of 77 witnesses was heard and over 600 exhibits were accepted into evidence.

27 31. On December 5, 2008, Hui/MTF, WWC, HC&S, and MDWS submitted their Proposed
28 FOF, COL, and D&O to the hearings officer. OHA filed a joinder to Hui/MTF, and only
29 Hui/MTF submitted a closing brief.

30 32. On April 9, 2009, hearings officer Miike submitted his Proposed FOF, COL, and D&O to
31 the Commission.

1 33. On May 11, 2009, the parties filed written exceptions to the hearings officer’s Proposed
2 FOF, COL, and D&O; and on Maui on October 15, 2009, the Commission heard the parties’ oral
3 arguments on their written exceptions.
4

5 **B. Traditional and Customary Practices in Nā Wai `Ehā**

6 34. Due to the profusion of fresh-flowing water in ancient times, Nā Wai `Ehā supported one
7 of the largest populations and was considered the most abundant area on Maui; it also figured
8 centrally in Hawaiian history and culture in general. (Exh. C-2, p. 19; Akana, WDT 9/14/07, ¶
9 12.) Hui/MTF FOF A-11.¹

10 35. The abundance of water in Nā Wai `Ehā enabled extensive lo`i kalo (wetland kalo)
11 complexes, including varieties favored for poi-making such as “throat-moistening lehua poi.”
12 (Exh. C-2, p. 7 (citing Kahā`ulelio 2006); Tr. 12/4/07, p. 19, l. 19 to p. 20, l. 3.) Hui/MTF FOF
13 A-12.

14 36. The four ahupua`a of Nā Wai `Ehā and their streams comprised the largest continuous
15 area of wetland taro cultivation in the islands. (Exh. C-2, pp. 1, 17 (citing Handy and Handy
16 1972, p. 496); Tengan, Tr. 12/4/07, p. 20, l. 19 to p. 21, l. 7; Holt-Padilla, WDT 9/14/07, ¶ 9.)
17 Hui/MTF FOF A-13.

18 37. `Īao Valley was known for its two famous `auwai called the Kama`auwai and
19 Kalani`auwai, which fed many kuleana lands. (Exh. C-2, p. 9.) Hui/MTF FOF A-16.

20 38. Numerous springs feeding lo`i kalo existed in the district of Wailuku in ancient days.
21 (Exh. C-2, p. 9.) Hui/MTF FOF A-17.

22 39. “All indications are that Waihe`e Valley was traditionally a rich, fertile valley supporting
23 a substantial population. Hawaiians constructed extensive lo`i (irrigated taro terraces) and

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. Written testimony is referred to as follows: name of the witness, the type and date of the written testimony, and the page and line numbers, or paragraph, of that testimony. “Decl.” means written declaration; “WDT,” written direct testimony; “WRT,” written rebuttal testimony; and “WST,” written surrebuttal testimony. Oral testimony is referred to as follows: name of the witness, the date of the transcript (“Tr.”), and the page and line numbers. For example, this Finding of Fact is referenced to Exhibit C-2, page 19; and Akana’s written direct testimony of 9/14/07, paragraph 12. This Finding of Fact was proposed by Hui/MTF as their FOF A-11, which was accepted.

1 elaborate `auwai systems to provide water for the lo`i . . . Many lo`i can be seen today, although
2 most are not in use.” (Exh. C-2, p. 10 (quoting Kelly & Hee 1987).) Hui/MTF FOF A-18.

3 40. In addition to extensive agricultural production, traditional and customary practices
4 thrived in Nā Wai `Ehā, including the gathering of upland resources, such as thatch and ti, and
5 protein sources from the streams, including `o`opu, `ōpae, and hihiwai. (Tengan, Tr. 12/4/07, p.
6 21, ll. 15-21.) Hui/MTF FOF A-19.

7 41. In Nā Wai `Ehā, the gathering of certain species of `o`opu was sometimes kapu
8 (reserved) for the chiefs. The name of the famous kili`o`opu wind of Waihe`e means faint odors
9 of the `o`opu, in reference to “the appetizing fragrance” of the `o`opu cooking in ti leaves, which
10 “wafted down by the wind to the chief’s door.” Maka`āinana from this area developed a method
11 to hide the scent of the cooking `o`opu by wrapping it in `olena leaves so the aroma could not
12 escape. (Exh. C-2, pp. 14-15 (quoting Rebecca Nu`uhiwa’s oral history).) Hui/MTF FOF A-20.

13 42. In the ahupua`a of `Īao, “the waters of the region provided for a diet which ‘consisted
14 mainly of fish (napili and nakea), opae, hihi-wai (all obtained from `Īao Stream), and lehua (red)
15 taro which was grown in lo`i (irrigated terraces) lining the banks of the stream.” (Exh. C-2, p.
16 14 (citing Connolly 1974).) Hui/MTF FOF A-21.

17 43. The waters of Nā Wai `Ehā were renowned for the traditional and customary practice of
18 hiding the piko, or the naval cord of newborn babies. (Tengan, Tr. 12/4/07, p. 22, ll. 2-12.)
19 “[T]he spring Eleile contained an underwater cave where the people of the area would hide the
20 piko (umbilical cords) of their babies after birth. . . . The location of where one buries or hides
21 the piko is a traditional custom that represents Native Hawaiian cultural beliefs about an
22 individual’s connection to the land.” (Exh. C-2, pp. 4-5 (citing Bishop Museum Archives Audio
23 Collection, HAW 84.2.3).) Hui/MTF FOF A-23.

24 44. Upper `Īao Valley contained the royal residences of chiefs in both life and the afterlife.
25 (Exh. C-2, pp. 11-12.) In a secret underwater cave, Native Hawaiians hid the bones of “all the
26 ruling chiefs who had mana and strength, and the kupua, and all those attached to the ruling
27 chiefs who were famous for their marvelous achievements. There were several hundred in all
28 who were buried there.” Thus, the burial of sacred chiefs required a deep freshwater body to
29 ensure the utmost protection of their bones. (*Id.* at p. 13 (quoting Ke Au Okoa 1870); Tengan, Tr.
30 12/4/07, p. 22, ll. 13-21.) Hui/MTF FOF A-24.

1 45. Nā Wai `Ehā is home to several important heiau. Of particular significance are Haleki`i
2 and Pihana Heiau, located between Waiehu and `Īao Streams. (Sites of Maui 64, Elspeth Sterling
3 ed., Bishop Museum Press 1998). These heiau were re-consecrated in 1776 as an offering before
4 the famous battle between Hawai`i and Maui. Id. It is said that Kalanikaukooluaole, a high
5 chiefess and daughter of Kamehamehanui, bathed in the stream water near the heiau, before she
6 entered the heiau. (Id. at 76.) Hui/MTF FOF A-25.

7 46. The presence of heiau (places of worship, temples) in a windward environment indicates
8 large populations and agricultural pursuits. In Nā Wai `Ehā, there are a total of 36 documented
9 heiau, which is the largest number of heiau among all Maui island communities and underscores
10 the cultural, historical, and political importance of this region. (Exh. C-2, p. 10 (citing Walker
11 1931, Thrum 1909, Bruce 1973, Stokes 1918, Cordy 1978).) Hui/MTF FOF A-26.

12 47. Nā Wai `Ehā's water resources sustained "the second largest population on the island of
13 Maui." (Exh. C-2, p. 9 (citations omitted).) "In 1831-32, 827 people resided in the Waihe`e
14 ahupua`a, representing a very large population" that was surpassed only by the population in `Īao
15 (or Wailuku) (Id.) Hui/MTF FOF A-27.

16 48. Nā Wai `Ehā's abundant water resources served as a base of political and economic
17 power for the region in ancient times. (Tengan, Tr. 12/4/07, p. 20, l. 23 to p. 21, l. 11.) Hui/MTF
18 FOF A-29.

19 49. Cultural experts and community witnesses provided uncontroverted testimony regarding
20 limitations on Native Hawaiians' ability to exercise traditional and customary rights and
21 practices in the greater Nā Wai `Ehā area due to the lack of freshwater flowing in Nā Wai `Ehā's
22 streams and into the nearshore marine waters. (See, e.g., Kekona, Tr. 12/4/07, p. 214, ll. 9-15;
23 Pellegrino, WDT 9/14/07, ¶ 33.) Hui/MTF FOF A-40.

24 50. "O`opu must once have been plentiful in Nā Wai `Ehā streams; the wind in Waihe`e is
25 called ka makani kili`o`opu, which means the wind that brings the faint odors of the `o`opu."
26 Today, however, "[i]t is very difficult to find `ōpae, hihiwai, and `o`opu in the streams of Nā
27 Wai `Ehā, large portions of which are frequently dry." (Holt-Padilla, WDT 9/14/07, ¶ 22.)
28 Hui/MTF FOF A-42.

29 51. Despite significant challenges, some Native Hawaiian practitioners in Nā Wai `Ehā
30 continue to exercise traditional and customary rights and practices, including "gathering stream
31 life such as hihiwai, `ōpae, `o`opu, and limu for subsistence and medicinal purposes," as well as

1 “cultivating taro for religious and ceremonial uses, gathering materials for hula, lua (ancient
2 Hawaiian martial arts), and art forms.” (Akana, WDT 9/14/07, ¶ 16.) Hui/MTF FOF A-45.

3 52. In Nā Wai `Ehā, it is a traditional Native Hawaiian practice for cultural practitioners to
4 gather in the ahupua`a in which she lives; an ahupua`a in which she has ancestral ties, even if no
5 family member then resides there; or an ahupua`a that “contains certain resources of value to her
6 as a member of a Hawaiian cultural group such as traditional Hawaiian healers, who may use a
7 specific area to gather lā`au lapa`au (native plants for medicine); hālau hula, whose chants and
8 dances may honor deities associated with a specific natural resource area, and which may need to
9 gather certain native plants from these areas; and fishermen, hunters, and gatherers who have
10 accessed and used the ahupua`a for subsistence.” (Holt-Padilla, WDT 9/14/07, ¶ 17.) Hui/MTF
11 FOF A-46.

12 53. Kumu hula Akoni Akana gathers materials such as hau, palapalai, la`ī, and laua`e from
13 Waihe`e and Waiehu for hula ceremonies and performances. (Akana, WDT 9/14/07, ¶ 6.) “As
14 part of the protocol for gathering these items, we always soak the leaves we gather in the stream
15 flow nearby. This practice necessitates a flowing stream.” (Id.) Hui/MTF FOF A-47.

16 54 The spiritual practice of hi`uwai, also known as kapu kai, often occurred around the time
17 of makahiki, when individuals “would go into the rivers or into the ocean in order to do a
18 cleansing for the new year[.]” (Holt-Padilla, Tr. 12/4/07, p. 192, l. 22 to p. 193, l. 8.) This type
19 of cleansing, which required immersion in the water, was also conducted “before you start or end
20 certain ceremonies[.]” (Id. p. 193, ll. 3-8, 21-23.) For ceremonies dedicated to Kāne, “having a
21 hi`uwai in a stream magnifies the mana[.]” (Id. p. 193, ll. 11-20.) Hui/MTF FOF A-51.

22 55. Other practitioners would like to expand the scope of their traditional and customary
23 practices and plan to do so if water is returned to the streams. For example, Hōkūlani Holt-
24 Padilla testified that “[m]any families seek to reestablish the tradition of growing kalo” in Nā
25 Wai `Ehā. (Holt-Padilla, Tr. 12/4/07, p. 190, ll. 9-13.) Hui/MTF FOF A-52.

26 56. Testimony contended that a subsistence lifestyle can be maintained in today’s cash
27 economy, but with “different demands upon subsistence growers. In the old days, you could pay
28 taxes to chiefs with taro. Those in-kind of tax payments are no longer allowable, so even
29 subsistence farmers would inevitably have to sell some of their taro for cash in order to pay
30 taxes.” (Tengan, Tr. 12/4/07, p. 26, ll. 10-22.) Hui/MTF FOF A-54.

1 57. According to testimony, “Nā Wai `Ehā continues to hold the potential to once again
2 support enhanced traditional and customary rights and practices if sufficient water is restored.”
3 (Exh. C-2, p. 19.) Restoring streamflow to Nā Wai `Ehā “would enormously benefit” Native
4 Hawaiians and other communities who seek to reconnect with their culture and live a self-
5 sustaining lifestyle, and more people would be able to engage in traditional and customary
6 practices with more water. (Tengan, Tr. 12/4/07, p. 25, l. 21 to p. 26, l. 9.) Hui/MTF FOF A-56.

7 58. Testimony contended that “Restoration of mauka to makai flow to the streams is critical
8 to the perpetuation and practice of Hawaiian culture in Nā Wai `Ehā.” “If we are not able to
9 maintain our connection to the land and water and teach future generations our cultural
10 traditions, we lose who we are as a people.” (Holt-Padilla, WDT 9/14/07, ¶ 25.) Hui/MTF FOF
11 A-57.

12 59. According to testimony, “The return of the waters of Nā Wai `Ehā to levels that can
13 sustain the rights of native Hawaiians and Hawaiians to practice their culture will result in the
14 betterment of the conditions of native Hawaiians and Hawaiians by restoring spiritual well-being
15 and a state of ‘pono’ (goodness, righteousness, balance) to the people and communities of Nā
16 Wai `Ehā.” (Apoliona, WDT 9/14/07, ¶ 11.) Hui/MTF FOF A-59.

17 60. Testimony contended that cold, free-flowing water is essential for kalo cultivation, which
18 in turn is integral to the well-being, sustenance, and cultural and religious practices of native
19 Hawaiians and Hawaiians. Kalo cultivation provides not only a source of food, but also spiritual
20 sustenance, promotes community awareness and a connection to the land, and supports physical
21 fitness and mental well-being. (Apoliona, WDT 9/14/07, ¶¶ 6-7.) Hui/MTF FOF A-66.

22 61. In Hawaiian culture, “[o]ur ancestor was the kalo itself.” Hōkūlani Holt-Padilla
23 explained:

24 The first born child of Wākea (Sky father) and Ho`ohōkūkalani (daughter
25 of Papa, the Earth mother) was stillborn. Shortly after being buried, his body
26 reemerged from the ground in the form of a kalo plant, which Wākea named
27 Hāloanakalaukapalili (long stem, trembling leaf). Their next child was a healthy
28 boy whom they named Hāloa after his deceased older sibling. Hāloa grew to be a
29 strong man and became the ancestor of all Hawaiians.

30 (Holt-Padilla, WDT 9/14/07, ¶ 11; Holt-Padilla, Tr. 12/4/07, p. 189, l. 11 to p. 190, l. 7.) See
31 also Tengan, Tr. 12/4/07, p. 17, l. 22 to p. 18, l. 8 (recounting the history of Hāloa). Hui/MTF
32 FOF A-67.

1 62. The story of Hāloa acknowledges Native Hawaiians’ familial relationship with kalo as an
2 elder sibling, and the resulting cultural significance of cultivating kalo in a traditional manner.
3 (Tengan, Tr. 12/4/07, p. 17, l. 22 to p. 18, l. 8.) Hui/MTF FOF A-68.

4
5 **C. Maintenance of Fish and Wildlife Habitats**

6 63. Out of the 376 perennial streams it identified in Hawai`i, the Commission has designated
7 only 44 streams statewide as “Candidate Streams for Protection.” Hawai`i Stream Assessment 5,
8 272 (1990) (hereinafter, “HSA”). Each of the Nā Wai `Ehā streams earned this designation
9 among only nine streams selected from the entire island of Maui. Id. at 276. The Commission
10 also designated the Nā Wai `Ehā streams as “Blue Ribbon Resources,” meaning that they
11 featured the “few very best resources” in their respective resource areas. Id. at 272. Hui/MTF
12 FOF C-1.

13 64. The native amphidromous fauna of Hawaiian streams consists of five species of goboid
14 fishes: *Awaous guamensis* (‘o‘opu nākea), *Sicyopterus stimpsoni* (‘o‘opu nōpili), *Lentipes*
15 *concolor* (‘o‘opu alamo‘o), *Stenogobius hawaiiensis* (‘o‘opu naniha), and the eleotrid *Eleotris*
16 *sandwicensis* (‘o‘opu akupa). Native amphidromous invertebrates include two gastropods,
17 *Neritina granosa* (hihiwai) and the estuarine *Neritina vespertina* (hapawai); and the decapods,
18 *Atyoida bisulcata* (‘opae kala‘ole) and *Macrobrachium grandimanus* (‘opae ‘oeha‘a). (Ford,
19 WDT 10/26/07, ¶ 31.) HC&S FOF 44.

20 65. The term “amphidromous” describes fishes that undergo regular, obligatory migration
21 between freshwaters and the sea at some stage in their life cycle other than the breeding period
22 (Myers 1949). All native Hawaiian amphidromous species exhibit “freshwater amphidromy”
23 where spawning takes place in freshwater, and the newly hatched larvae are swept into the sea by
24 stream currents. While in the marine environment, the larvae undergo development as
25 zooplankton before returning to freshwater to grow to maturity. An important ecological
26 characteristic of the amphidromous fauna is the ability to move upstream, surmounting riffles
27 and small falls, and for some species even very high waterfalls (Ford & Kinzie 1982, Radtke &
28 Kinzie 1996). (Ford, WDT 10/26/07, ¶ 30.) HC&S FOF 45.

29 66. The life history of amphidromous stream macrofauna can be divided into three phases:
30 recruitment into the stream, adult population biology and instream habitat use, and reproductive

1 output. All of these must be operative for a population in a particular stream to be considered
2 successful. (Exhibit E-53, p. 39 (§ 7.5.1).) HC&S FOF 46.

3 67. The five native Hawaiian amphidromous species have no distinct breeding season.
4 (Lindstrom, Tr. 10/18/08, p. 46, ll. 12-15.) HC&S FOF 47.

5 68. An overriding factor impairing the biological and ecological integrity of diverted Central
6 Maui streams, compared to their non-diverted counterparts, is the disruption of natural flow via
7 large-scale offstream diversions. (Benbow, WDT 9/14/07, ¶ 8.) Hui/MTF C-7.

8 69. Diversions of streamflow harm stream life by degrading or destroying habitat,
9 diminishing food availability, and disturbing species interactions and food web processes.
10 Particularly during low flow or drought conditions, the diversions exaggerate the negative impact
11 of low flows and can eliminate most stream life and habitat below the diversions and leave the
12 streams barren of recruitment. (Benbow, WDT 9/14/07, ¶¶ 9, 32.) Hui/MTF FOF C-8.

13 70. Stream diversions have been found to dampen the natural seasonal discharge cycle,
14 exacerbate natural low flow conditions, and increase the likelihood of prolonged periods of
15 extremely low flow. (Exh. A-221, p. 53.) Hui/MTF FOF C-9.

16 71. Diversions particularly compromise the life cycles of native amphidromous species in
17 numerous ways that compound the negative impacts on their overall populations from mauka to
18 makai. (Benbow, WDT 9/14/07, ¶ 12.) Hui/MTF FOF C-10.

19 72. Diversions diminish larval drift by capturing eggs and larvae. (Benbow, WDT 9/14/07, ¶
20 11; Payne, Tr. 12/12/07, p. 74, l. 24 to p. 75, l. 5; p. 75, ll. 21-24.) Hui/MTF FOF C-11.

21 73. Diversions also impair flows necessary to transport larvae to the ocean. Any factor that
22 hinders flow or increases retention time in a stream will delay the transport of larvae to the
23 marine environment and negatively impact and possibly kill larvae. (Exh. A-220, p. 55;
24 Lindstrom, Tr. 10/14/08, p. 59, ll. 8-11; p. 19, ll. 2-10.) Hui/MTF FOF C-12

25 74. Terminal discharge at the stream mouth into the ocean of sufficient duration and volume
26 is necessary to attract and accommodate upstream migration of post-larval fishes, mollusks, and
27 crustaceans. (Ford WDT 10/26/07, ¶ 55.) Hui/MTF FOF C-15.

28 75. There is a direct correlation between streamflow volume under non-freshet conditions
29 and postlarval recruitment in Central Maui streams, such that increased streamflow correlates
30 with increased recruitment at the stream mouth. (Benbow, WDT 9/14/07, ¶ 37; Benbow, Tr.
31 12/10/07, p. 21, ll. 9-12.) Hui/MTF FOF C-36.

1 76. Hui/MTF’s expert witness maintains that “the amphidromous life cycle requires
2 continuous flow to link biologically the mountains (mauka) to the ocean (makai).” Benbow,
3 WDT 9/14/07, ¶ 10.) Hui/MTF FOF C-4.

4 77. HC&S’s expert witness states that “(i)t has not been definitively established that the life
5 cycle of native Hawaiian amphidromous species absolutely depends on continuous mauka to
6 makai flow. There are naturally interrupted and intermittent streams in Hawai‘i that host
7 amphidromous organisms. Statewide surveys conducted by the Division of Aquatic Resources
8 (“DAR”) have found an abundance of ‘o‘opu alamo‘o and ‘opae in the upper reaches of leeward
9 streams that were assumed to be dry year round. Standing pools in the mid-reaches of such
10 streams provide ecologically important habitat for native amphidromous species during baseflow
11 and drought conditions. (Ford, WDT 10/26/07, ¶ 8; Ford, Tr. 12/10/07, p. 213, ll. 11-22, p. 214, l.
12 21 to p. 215, l. 3.) HC&S FOF 48.

13 78. HC&S’s expert witness thus distinguishes between “ecological” and “physical”
14 connectivity: “Ecological connectivity in a stream is more important than physical connectivity
15 for purposes of sustaining the biological integrity of the stream. Ecological connectivity exists if
16 stream flows of sufficient volume and frequency allow the normal distribution of native
17 amphidromous species within a given watershed. Physical connectivity exists if there is
18 uninterrupted flow of surface waters between the headwaters of a stream and its mouth.
19 Ecological connectivity could exist irrespective of whether there is physical connectivity. (Ford,
20 Tr., 12/10/07, p. 219, l. 24 to p. 221, l. 7; Exhibit E-53 at 4, n.1 (§ 1.0), and 43 (§ 8.0))

21 79. Ultimately, the precise volume and duration of stream flow needed to sustain the life
22 cycle of amphidromous organisms is not known. (Benbow, Tr. 12/10/07, p. 76, l. 18 to p. 77, l.
23 16.) HC&S FOF 48.

24
25 **D. The Nā Wai `Ehā Streams**

26 80. Nā Wai `Ehā, or “the four great waters of Maui,” refers to the Waihe`e River and Waiehu,
27 `Īao, and Waikapū Streams. (Exh. E-53, p. 4, Exh. C-2, p. 1; Oki WDT 9/14/07, ¶ 5.) WWC FOF
28 31.

29 81. The Waihe`e River is the northern-most of the four waters. Flowing in a long, deep,
30 narrow valley, it drains the northeast slopes of the West Maui Mountains. Running a distance of
31 about 26,585 feet, its watershed covers an area of about 4,500 acres. It is the principal source of

1 water in the Nā Wai `Ehā area. ((Exh. E-2; Exh. A-3, p. 22; Exh. E-53, fig. 1 and 11.) WWC
2 FOF 46-49.

3 82. Waiehu Stream is formed by the confluence of the North and South Waiehu Streams.
4 Running a distance of about 23,700 feet, its watershed covers an area of about 6,600 acres. ((Exh.
5 A-3, p. 21; Exh. E-53, fig. 1 and 12.) WWC FOF 50-51.

6 83. `Īao Stream is the second largest in Nā Wai `Ehā. Draining a large amphitheater-headed
7 valley, it runs for a distance of about 38,000 feet. Its watershed covers an area of about 14,500
8 acres. A significant portion of its lower reaches was channelized and the stream bed and banks
9 hardened with concrete by the United States Army Corps of Engineers for flood control and
10 drainage. (Exh. A-3, p. 20; Exh. E-53, p. 8, fig. 1, and fig. 13.) WWC FOF 52-55.

11 84. Waikapū Stream is the southern-most stream. The longest of the four streams, it is about
12 63,500 feet in length, with a watershed (Waikapū Valley) that covers about 9,000 acres. (Exh. E-
13 2; Exh. A-3, p. 20; Exh. E-53, fig. 1 and 14.) WWC FOF56-58.

14 85. There are three types of ground water systems in the Nā Wai `Ehā area: (1) dike
15 impounded; (2) the basal freshwater lens; and (3) perched. (Oki, WDT 9/14/07, ¶ 7.) WWC FOF
16 36.

17 86. Dike-impounded ground waters occur at high elevations; basal freshwater lenses and
18 perched waters occur at lower elevations closer to the coast. (Oki, WDT 9/14/07, ¶ 7.) WWC
19 FOF 37.

20 87. Gaining reaches of streams are those in which ground water contributes to the streamflow
21 by a breaching of the ground water system by the stream. (Oki, WDT 9/14/07, ¶ 10.) WWC FOF
22 40.

23 88. Losing reaches of streams are where the channel bottoms are above the water table and
24 an unsaturated zone exists between the stream and water table. (Oki, WDT 9/14/07, ¶ 12.) WWC
25 FOF 41.

26 89. In the upper reaches of the Nā Wai `Ehā area, the stream channels intersect the dike-
27 impounded ground waters, which results in a contribution of ground water to the stream, making
28 the streams gaining in the upper reaches. (Oki, WDT 9/14/07, ¶ 10.) WWC FOF 42.

29 90. In the lower reaches of the Nā Wai `Ehā area, the stream channels overlie the basal
30 freshwater lenses, allowing stream waters to migrate from the stream bed to the basal lenses,
31 making the streams losing in the lower reaches. (Oki, WDT 9/14/07, ¶ 12.) WWC FOF 43.

1 91. At the mouths of the streams in the Nā Wai `Ehā area, some of the stream channels
2 intersect the basal freshwater lenses, making those streams gaining in that area. (Oki WDT
3 9/14/07, ¶ 13.) WWC FOF 44.

4 92. The Nā Wai `Eha streams are generally gaining streams above the existing diversions
5 (described *infra*) and losing streams below the diversions. (Oki, Tr., 12/6/07, p. 57, ll. 14-16.)
6 WWC FOF 45.

7 93. The loss rate in a stream is expected to increase as flow increases because: 1) the
8 potential streambed area through which infiltration of water can occur increases with flow; and
9 2) the increased water level in the stream creates a large vertical hydraulic gradient, which
10 controls the rate of subsurface flow. In addition, loss rates change as a function of the
11 permeability of the streambed sediments, which may vary over different stream reaches. (Oki,
12 WDT 9/14/07, ¶ 54.)

13 94. A USGS study of stream flows in Hawai`i concluded that flows had decreased
14 significantly over a 90-year period. (Exh. E-53, p. 16.) WWC FOF 445.

15 95. While USGS has not observed any significant trends in median flows in the Waihe`e
16 River over the period, 1984 to 2005, (Oki, Tr. 12/6/07, p. 78, ll. 7-21) WWC FOF 446, USGS
17 data also show that average (or mean) monthly total stream flows for the Waihe`e River and `Īao
18 Stream for the three 8-year periods 1984-1991, 1992-1999, and 2000-2007, decreased by about
19 25 percent and 10 percent, respectively. For Waihe`e Stream, the monthly flows averaged 1639.1
20 mgd, 1436.0 mgd, and 1236.6 mgd, respectively, for these eight-year periods. These monthly
21 averages translate into daily averages of 54.64 mgd for 1984-1991, 47.87 mgd for 1992-1999,
22 and 41.22 mgd in 2000-2007. (Exh. D-45, p. 17-18; Suzuki, Tr. 12/14/07, p. 83, ll. 4-9 and 13-
23 17.) WWC FOF 453-454, 586-587. (**See** FOF 97, *infra*, for a description of median flow.)

24

25 **1. Stream Flows**

26 96. One of the most useful ways to summarize stream-flow data is through the use of flow-
27 duration curves. A flow-duration curve shows the percentage of time that specified stream flows
28 were equaled or exceeded during a given period of record. (Oki, WDT 9/14/07, ¶ 21.) Hui/MTF
29 FOF B-51-52.

30 97. The Q₅₀ flow, or median flow, is the flow that is equaled or exceeded 50 percent of the
31 time and is “reflective of typical flow conditions.” (Oki, WDT 9/14/07, ¶ 21; Oki, Tr. 12/6/07, p.

1 78, ll. 17-21.) Hui/MTF FOF B-52-53. For example, a Q_{50} of 25 mgd means that the flow of the
2 specified stream was 25 mgd or more for half of the measurements of stream flow and less than
3 25 mgd for the other half of the measurements during the specified period of time; e.g., “the Q_{50}
4 for stream X was 25 mgd for the period 1985-2000.”

5 98. Stream flow consists of: (1) direct runoff, or overland flow and subsurface storm flow
6 (or interflow) that rapidly returns infiltrated water to the stream following a period of rainfall; (2)
7 ground water discharge, or base flow, where the stream intersects the water table; (3) water
8 returned from stream bank storage; (4) rain that falls directly on streams; and (5) any additional
9 water, including excess irrigation water, discharged to the stream by humans. (Oki, WDT
10 9/14/07, ¶ 19; Oki, Tr. 12/6/07, p. 126, l. 14 to p. 127, l. 2; Exh. A-201.) Hui/MTF FOFB-42.

11 99. Because ground water levels vary over time, base flow also varies: base flow is higher
12 during periods when the ground water level is high; lower during periods when the ground water
13 level is low; and may cease if the ground water level is lowered below the water level in the
14 stream. (Oki, WDT 9/14/07, ¶ 20; Oki, WDT 2/20/08, ¶ 3; Oki, Tr. 2/21/08, p. 27, ll. 8-25; Exh.
15 A-201; Exh. A-202.) Hui/MTF FOF B-47.

16 100. Although measurement of flow in a stream on any given day will reflect the total flow in
17 the stream, separating base flow from total flow is helpful to indicate the ground water
18 contribution to a stream. (Oki, WDT 9/14/07, ¶ 20; Oki, Tr. 2/21/08, p. 55, ll. 14-18.) Hui/MTF
19 FOF B-46.

20 101. For stream flows where more than ground water discharge is contributing to stream flow,
21 the United States Geological Survey (“USGS”) uses a computerized base-flow separation
22 method: 1) to estimate the percent of total flow that comes from ground water discharge as total
23 flow varies; and 2) averages these variations to estimate mean base flow. USGS has concluded
24 that mean base flow of perennial streams in Hawai`i generally is between the Q_{60} to Q_{80} flows.
25 (Oki, WDT 9/14/07, ¶ 21; Oki, WDT 2/20/08, ¶ 6; Exh. A-7; Exh. A-201.) Hui/MTF FOF B-54.

26 102. Thus, USGS has concluded that in general, the Q_{70} discharge could be an appropriate
27 estimate of mean base flow for Hawai`i streams. (Oki, WDT 9/14/07, ¶ 21; Oki, Tr. 12/6/07, p.
28 29, l. 25 to p. 30, l. 1.) Hui/MTF FOF B-58. USGS did not apply its model specifically to the Nā
29 Wai `Ehā streams. (Oki, Tr. 2/21/08, p. 39, ll. 16-19.)

30 103. In dry periods, the model assumes that the base and total flow are the same. In wetter
31 periods, the model uses criteria designed to take away the rain, runoff, and seepage components

1 of stream flow to try to estimate the average base flow at all times when the stream is flowing.
2 Although it has been tested against some form of data, ultimately there is no solid way of
3 validating the model and its results. (Oki, Tr. 2/21/08, p. 38, l. 17 to p. 39, l. 15, p. 71, l. 24 to p.
4 73, l. 2.)

5 104. The Q_{90} flow is commonly used to characterize low flows in a stream. In Hawai'i, Q_{90}
6 flows may range from near zero for ephemeral streams in areas that receive little rainfall, to tens
7 of cubic feet per second in areas that receive significant rainfall or ground water discharge. (Exh.
8 A-201, p. 3.) (The Q_{100} flow represents the lowest flow recorded in the stream, which is most
9 likely all from ground water discharge.)

10 105. USGS does not calculate base flow for water management purposes; instead, base flows
11 are calculated for other purposes, such as extracting the direct runoff components of total stream
12 flow for estimating water budgets (underestimating base flow results in overestimating direct
13 runoff), identifying the raw component of rainfall when estimating recharge, and surveying how
14 conditions such as base flow may have changed over time. (Oki, Tr. 2/21/08, p. 55, ll. 4-13; p.
15 32, ll. 9-25.) Hui/MTF FOF B-59, B-61.

16

17 2. Waihe'e River

18 106. Waihe'e River and its main diversions are shown in Figure 1.

19 107. In the period of climate years 1984-2005 (a climate year begins on April 1 and is
20 designated by the calendar year in which it begins) at USGS stream-gaging station 16614000 on
21 Waihe'e River near an altitude of about 605 feet upstream of all diversions, the minimum daily
22 mean flow (Q_{100}) was 14 mgd (this minimum flow occurred on only 6 days over 22 years, an
23 average of about 0.3 days per year). The Q_{90} flow was 24 mgd; the Q_{70} flow was 29 mgd; and the
24 Q_{50} flow was 34 mgd. (Oki, WDT 9/14/07, ¶¶ 23 and 53.) HC&S FOF 1.

25 108. The two main diversions are Waihe'e Ditch near an altitude of about 600 feet, and
26 Spreckels Ditch, near an altitude of about 400 feet and about 0.6 miles downstream from the
27 Waihe'e Ditch. (Oki, WDT 9/14/07, ¶ 53.)

28 109. Estimated stream flow losses in Waihe'e River downstream of the Spreckels Ditch may
29 range from 2.1 to at least 5.9 mgd. Although actual losses may vary as a function of streamflow,
30 because data are limited, a constant loss of 4 mgd is assumed by USGS. (Oki, WDT 9/14/07, ¶
31 56.)

1 110. Water also returns to the River in the form of return flows and leakage from ditches at
2 several locations downstream of the diversions. In some places, the return flows enter the River
3 in well-defined channels, whereas in other places the return flows enter as diffuse flows. (Oki
4 WDT 9/14/07, ¶¶ 38.)

5 111. Waihe`e and Spreckels Ditches are capable of diverting all of the dry-weather flow
6 available at the intakes. However, stream flow immediately downstream of the intakes may exist
7 because of leakage through or subsurface flow beneath the dams at these sites. Estimated dry-
8 weather flow immediately downstream of the Waihe`e and Spreckels Ditch intakes commonly is
9 on the order of about 0.1 mgd, but the stream may not have continuous surface flow from mauka
10 to makai. (Oki WDT 9/14/07, ¶ 44.)

11 12 **3. Waiehu Stream**

13 112. North Waiehu Stream and its main diversion are shown in Figure 2.

14 113. Low-flow characteristics for North Waiehu Stream during the 1984-2005 climate years
15 were estimated using record-extension techniques and available historical data during 1911-1917
16 from discontinued USGS gaging stations 16608000, 16609000, and 16609500. The minimum
17 discharge (Q_{100}) measured at gaging station 16608000 at an altitude of 880 feet was 1.6 mgd
18 during March 1915. The estimated Q_{90} discharge ranges from 1.4 to 2.7 mgd for 1984-2005; the
19 estimated Q_{70} discharge ranges from 2.3 to 2.7 mgd; and the estimated Q_{50} discharge ranges from
20 3.1 to 3.6 mgd. (Oki, WDT 9/14/07, ¶¶ 24 and 57.) HC&S FOF 2.

21 114. Water is diverted by the North Waiehu Ditch near an altitude of about 860 feet. (Oki,
22 WDT 9/14/07, ¶ 57.)

23 115. USGS estimates that the stream loses 1.3 mgd between the North Waiehu Ditch and the
24 confluence of North and South Waiehu Streams. (Oki, WDT 9/14/07, ¶ 60.)

25 116. The North Waiehu Ditch generally diverts most of the water available at the diversion
26 structure, but leakage from the North Waiehu Ditch may sometimes return to the stream. (Oki,
27 WDT 9/14/07, ¶¶ 39, 44.)

28 117. South Waiehu Stream and its main diversion are also shown in Figure 2.

29 118. Regarding the “Cerizos Kuleana Ditch” shown in Figure 2, in identifying the kuleana
30 ditches and their stream sources, WWC identifies South Waiehu Stream as the source of the
31 Cerizos Kuleana Ditch. (Exh. D-7; also citing Cerizo’s WDT of 9/14/07.) WWC FOF 152. But

1 Cerizos testified that he recently bought kuleana land on Waikapū Stream, (Cerizo, WDT
2 9/14/07, ¶¶ 1-2, 4-5; Exh. A-23; Exh. A-194D) Hui/MTF FOF 365, so it is unclear whether this
3 ditch is misnamed.

4 119. Low-flow characteristics for South Waiehu Stream for the 1984-2005 climate years were
5 estimated using record-extension techniques and available historical data during 1911-1917 from
6 discontinued USGS gaging station 16610000. The minimum discharge (Q_{100}) measured at gaging
7 station 16610000 at an altitude of 870 feet was 1.5 mgd during July 1913. Near gaging station
8 16610000 at an altitude of 870 feet, the estimated Q_{90} discharge ranges from 1.3 to 2.0 mgd for
9 1984-2005; the estimated Q_{70} discharge ranges from 1.9 to 2.8 mgd; and the estimated Q_{50}
10 discharge ranges from 2.4 to 4.2 mgd. (Oki, WDT 9/14/07, ¶¶ 25 and 57.) HC&S FOF 3.

11 120. Water is currently diverted from South Waiehu Stream by the Spreckels Ditch and two
12 kuleana ditches farther upstream. The main diversion is the Spreckels Ditch, near an altitude of
13 about 270 feet and about 1000 feet upstream from the confluence of North and South Waiehu
14 Streams. (Oki, WDT 9/14/07, ¶¶ 40, 57.)

15 121. No information is available on estimated losses in South Waiehu Stream, but USGS
16 estimates that the loss in Waiehu Stream itself, between the confluence of North and South
17 Waiehu Streams and the mouth, is 0.6 mgd. (Oki, WDT 9/14/07, ¶ 60.)

18 122. Return flows and leakage from the kuleana ditches have been observed entering South
19 Waiehu Stream. In addition, overflow or releases from the Waihe'e and Spreckels Ditches may
20 sometimes enter South Waiehu Stream. (Oki, WDT 9/14/07, ¶ 40.)

21 123. Spreckels Ditch is commonly capable of diverting all of the flow of South Waiehu
22 Stream during dry-weather conditions, although stream flow immediately downstream of the
23 intake may exist because of leakage through or subsurface flow beneath the dam at the intake.
24 Waiehu Stream is commonly dry farther downstream near Lower Waiehu Beach Road, and
25 therefore, Waiehu Stream does not flow continuously from mauka to makai. (Oki, WDT 9/14/07,
26 ¶ 46.)

27 124. There is extensive channel erosion below the Spreckels Ditch on South Waiehu Stream,
28 with a 12-foot drop in the elevation of the stream just below the diversion, and there is a vertical
29 concrete apron located just below the highway culverts in lower Waiehu Stream. (Exh. E-53, pp.
30 29, 44.) WWC 629, 650.

31

1 **4. `Īao Stream**

2 125. `Īao Stream and its main diversions are shown in Figure 3.

3 126. On the basis of 22 years of complete records (climate years 1984-2005) at USGS stream-
4 gaging station 16604500 on `Īao Stream near an altitude of about 780 feet and above all
5 diversions, the minimum daily mean flow (Q_{100}) was 7.1 mgd (the minimum flow occurred on 29
6 days over 22 years, an average of about 1.3 days per year); the Q_{90} flow was 13 mgd; the Q_{70}
7 flow was 18 mgd; and the Q_{50} flow was 25 mgd. (Oki, WDT 9/14/07, ¶¶ 26 and 61.) HC&S FOF
8 4.

9 127. The two main diversions are `Īao-Waikapū and `Īao-Maniania Ditches near an altitude of
10 about 780 feet (there is also a small privately owned pipe farther downstream), and the Spreckels
11 Ditch, near an altitude of about 260 feet and about 2.4 miles downstream from the `Īao-Waikapū
12 and `Īao-Maniania Ditches. (Oki, WDT 9/14/07, ¶¶ 41, 61.)

13 128. The `Īao Flood Control Project starts about 2.5 miles above the mouth of `Īao Stream and
14 consists of a debris basin, a concrete channel that runs from the debris basin to just downstream
15 of North Market Street, a 20-foot vertical drop, a broadened but unlined channel running to
16 Waiehu Beach Road, and concrete wing walls running about one-half of the distance from the
17 Waiehu Beach Road to the mouth of the stream. (Exh. E-53, p. 8.) WWC FOF 496. In 2008, a
18 \$30 million project was advertised to line the remaining Control Project channel and raise
19 existing levees to eliminate future flooding and levee failure. (Exh. E-53, p. 8.) WWC FOF 497.

20 129. USGS estimates that `Īao Stream loses 6.3 mgd in reaches that are not lined with concrete
21 and that are downstream of the `Īao-Maniania Ditch diversion (which is at about 780 feet
22 elevation), or 3.00 miles from about 595 feet elevation down to 35 feet elevation. (Oki, WDT
23 9/14/07, ¶¶ 62-64.)

24 130. Water that overflows or leaks from the ditch systems or that is discharged through gates
25 in the systems sometimes returns to `Īao Stream downstream of the diversions. (Oki, WDT
26 9/14/07, ¶ 41.)

27 131. In the absence of ditch return flows and runoff during and following periods of rainfall,
28 `Īao Stream remains dry in some reaches downstream of the main diversion intake for the `Īao-
29 Maniania and `Īao-Waikapū Ditches and does not flow continuously from mauka to makai. (Oki,
30 WDT 9/14/07, ¶ 47.)

31

1 **5. Waikapū Stream**

2 132. Waikapū Stream and its main diversions are shown in Figure 4.

3 133. On the basis of record extension techniques applied by USGS to the historical data from
4 Waikapū Stream near gaging station 16650000 near an altitude of about 880 feet, the estimated
5 Q₉₀ flow was from 3.3 mgd to 4.6 mgd during climate years 1984-2005; the estimated Q₇₀ flow
6 was 3.9 mgd to 5.2 mgd, and the estimated Q₅₀ flow ranged from 4.8 mgd to 6.3 mgd. The
7 lowest recorded flow was 3.3 mgd in October 1912. (Oki, WDT 9/14/07, ¶ 27.) HC&S FOF 5.

8 134. The record extension techniques applied to the historical data to estimate the natural flow
9 near gaging station 16650000 combined 1910-1917 historical data from gaging station 16650000,
10 flows in the South Side Waikapū Ditch near an altitude of about 1,120 feet, and flows in the
11 Everett Ditch near an altitude of about 900 feet. (Oki, WDT 9/14/07, ¶ 27.) While the Everett
12 Ditch is no longer active, the South Side Waikapū Ditch is. The estimates of natural flow assume
13 no gains, losses, or return flows between the South Side Waikapū Ditch diversion and station
14 16650000 during the period when the gaging stations were operated. Recent USGS seepage-run
15 data from 2004 indicate no significant net gain or loss between the South Side Waikapū Ditch
16 diversion and station 16650000. (Oki, WDT 9/14/07, ¶ 27.) Thus, the estimated natural flows
17 just above the South Side Waikapū Ditch diversion should be the same as those estimated at
18 station 16650000, while the actual flows at gaging station 16650000 for climate years 1984-2005
19 should be lower than the estimated natural flow for climate years 1984-2005 by an amount
20 currently diverted at the South Side Waikapū Ditch.

21 135. Active diversions on Waikapū Stream include the South Side Waikapū Ditch near an
22 altitude of about 1,120 feet, an intake on the Waihe`e Ditch (elevation not specified), and the
23 Reservoir 6 Ditch (elevation not specified). (**See** Figure 5.)

24 136. Numerous return flows have been observed in Waikapū Stream downstream of the
25 diversions. (Oki, WDT 9/14/07, ¶ 42.)0

26 137. Diversions in Waikapū Stream may not cause the stream to be dry immediately
27 downstream of the diversions, although it is commonly dry downstream of all diversions because
28 of infiltration losses into the streambed, and the stream does not flow continuously from mauka
29 to makai. (Oki, WDT 9/14/07, ¶ 48.)

30
31

1 **E. Withdrawals and Diversions**

3 **1. Keponiwai Well**

4 138. MDWS's Keponiwai Well (Well No. 5332-05) draws dike-impounded ground water.
5 (Eng, Dec. 9/14/07, ¶ 10.) MDWS FOF 10.

6 139. Water from the Keponiwai Well is piped to MDWS's 'Īao Tank, which in turn ties into
7 the County's water system. (Eng., Dec., ¶ 18.) MDWS FOF 13.

8 140. MDWS has a WUPA for 1.042 mgd. (**See** FOF 17, *supra*.)

10 **2. Tunnels**

11 141. Twelve tunnels were known to be excavated in Nā Wai 'Ehā between 1900 and 1926.
12 (Oki, WDT 9/14/07, ¶ 16 (citing Stearns and Macdonald, 1942); Exh. A-5, p. 23.) Hui/MTF FOF
13 B-29.

14 142. Eight tunnels were excavated in Nā Wai 'Ehā's dike complex and tap dike-impounded
15 ground water. (Oki, WDT 9/14/07, ¶ 16; Exh. A-5, p. 23.) Hui/MTF FOF B-30.

16 143. The other four tunnels were excavated beneath 'Īao and Waiehu Streams and collect
17 water from beneath the streams in the valley-floor alluvium. (Oki, WDT 9/14/07, ¶ 16; Exh. A-5,
18 p. 23.) Hui/MTF FOF B-31.

19 144. About nine mgd of dike-impounded ground water was developed by tunnels, although
20 most of the water (7.5 mgd) may have discharged naturally to streams below the level of the
21 tunnels had it not been intercepted by the tunnels. (Oki, WDT 9/14/07, ¶ 16 (citing Stearns and
22 Macdonald, 1942); Exh. A-3, p. 29; Exh. A-5, p. 23.) Hui/MTF FOF B-32.

23 145. The tunnels that discharge directly into the streams include the five tunnels for which
24 WWC submitted WUPAs—Black Gorge Tunnel, 'Īao Needle Tunnels No. 1 and No. 2, and
25 Waikapū Tunnels No. 1 and No. 2 (FOF 17, *supra*.)

26 146. Waikapū Tunnel No. 1 flows into a tributary that joins Waikapū Stream below the
27 diversion for the South Side Waikapū Ditch (**See** Figure 4), but its estimated yield is less than
28 0.01 mgd. (Exh. E-2; Exh. A-3, p. 30.) WWC FOF 776-777.

29 147. Waikapū Tunnel No. 2 flows into Waikapū Stream above the South Side Waikapū Ditch
30 (**See** Figure 4) and has an estimated yield of 1.0 mgd. (Exh. A-3, p. 30.) WWC FOF 776.

1 148. Black Gorge Tunnel and `Īao Needle Tunnels No. 1 and No. 2 discharge into `Īao Stream
2 above all diversions (See Figure 3). Development of the `Īao Tunnel (MDWS/WWC's Well No.
3 5332-02, *infra*) caused the Black Gorge Tunnel to go dry. (Oki, WDT 9/14/07, ¶ 26, citing
4 Yamanaka and Huxel, 1970.) There is no information available to quantify the effects of `Īao
5 Needle Tunnels No. 1 and No. 2 on `Īao Stream's total flow. (Oki, WDT 9/14/07, ¶ 26.) WWC
6 FOF 562.

7 149. Waihe`e North and Waihe`e South Tunnels (See Figure 1), built in 1909, may have
8 contributed to the total flow of Waihe`e River for a period of time after their construction, but it
9 is not likely that they presently contribute appreciably to the total flow. (Oki, WDT 9/14/07, ¶
10 23.) WWC FOF 431-432.

11 150. The County of Maui and WWC built the `Īao Tunnel (Well No. 5332-02) in 1937. (Exh.
12 D-8(a), D-8(b), D-8(c); Ex. B-4; Eng, WDT, p. 5; Exh. D-37.) WWC FOF 808-809, 811-813.

13 151. Water from the `Īao Tunnel is first directed to MDWS's water treatment plant, and the
14 remainder enters the ditch at WWC's `Īao Stream diversion. (See Figure 3.)

15 152. Under an agreement between WWC and MDWS, MDWS uses 1.074 mgd, with WWC
16 having the use for the amounts over 1.074 mgd. MDWS pays WWC a delivery fee for any
17 amounts in excess of 1.074 mgd. (Chumbley, WRT 10/29/07, ¶ 10; Chumbley, Tr. 1/15/08, p.
18 10, ll. 48-50; Chumbley, Tr. 1/16/08, pp. 85, 88-89.) WWC FOF 815-817.

19 153. MDWS has a WUPA for 1.359 mgd (See FOF 17, *supra*), and WWC has been using
20 between 0.25 to 0.35 mgd. (Exh. D-32; Chumbley, WST 11/19/07, pp. 5, 7-8; Chumbley, Tr.
21 1/15/08, pp. 10-11, 53-54 and 127.) MDWS FOF 61, WWC FOF 832.

22 154. HC&S has a separate `Īao Tunnel (Well No. 5330-02), for which it has a WUPA for 0.1
23 mgd. (See FOF 17, *supra*.)

24 155. HC&S's `Īao Tunnel discharges into the Spreckels Ditch between HC&S's intakes on
25 South Waiehu and `Īao Streams. (Hew, WDT 1/29/08, ¶ 11D.) HC&S FOF 88D. (*For the*
26 *description of the Spreckels Ditch, see FOF 184-192, infra.*)

27

28 3. Ditches

29 156. There are two primary and two secondary systems that distribute the waters diverted from
30 the Nā Wai `Ehā streams. (Suzuki, WDT 9/12/07, pp. 1-16.) WWC FOF 59.

1 157. The primary distribution systems are the WWC ditch system and the HC&S
2 reservoir/ditch system. (Suzuki, WDT 9/12/07, pp. 1-16.) WWC FOF 60.
3 158. The secondary distribution systems are the “kuleana” ditches/pipes that either have an
4 intake directly in a stream or that receive waters from the primary systems, and the MDWS water
5 treatment plants. (Suzuki, WDT 9/12/07, p. 15.) WWC FOF 61.
6 159. Almost all of the kuleana distribution systems receive water by delivery from ditches or
7 reservoirs that are a part of the primary distribution systems. (Suzuki, WDT 9/12/07, p. 15; Exh.
8 D-99.) WWC FOF 62.
9 160. These distribution systems and the end users are called “kuleana” because they were not
10 charged for water delivery. They may or may not have appurtenant or riparian rights. (Chumbley,
11 WDT 9/12/07, p. 10.) WWC FOF 63.
12

13 **F. The Primary Distribution Systems**

14 161. The primary distribution systems receive stream waters via nine active diversions, two on
15 Waihe`e River, one on North Waiehu Stream, one on South Waiehu Stream, two on `Āao Stream
16 and three on Waikapū Stream. (Exh. D-99.) WWC FOF 64.
17 162. Historically, there were three additional diversions, one on Waihe`e which is presently
18 sealed (Field 1 intake), one on `Āao that no longer exists (Kama Ditch), and one on Waikapū that
19 is presently sealed (Everett Ditch). (Exh. D-99.) WWC FOF 65.
20 163. In addition, there are three kuleana intakes directly on the streams, one each in South
21 Waiehu, `Āao, and Waikapū Streams. (Exh. D-99; Cerizo WDT 9/14/07; Pellegrino, WDT
22 9/14/07; Duey WDT 9/14/07.) WWC FOF 153.
23 164. WWC and its predecessors used the system to divert water from the streams and deliver it
24 to users for agricultural (crops and animals), industrial (commerce and stores), and domestic
25 (camps, villages and towns) purposes. (Exh. D-9, p. 28; Suzuki, WDT 9/12/07, p. 8; Chumbley,
26 WDT 9/12/07, pp. 3, 4; Exh. C-85, p. 7:12-14.) WWC FOF 73.
27 165. In 1862, WWC’s predecessor was formed and started cultivation of fields to grow sugar
28 cane. (Exh. D-48; Chumbley, Tr. 1/15/08, p.19, ll. 4-20.) WWC FOF 68.
29 166. Ditches to deliver water diverted from the streams to irrigate the sugar cane were first
30 used in 1862. (Exh. D-48; Chumbley, Tr. 1/15/08, p. 19, ll. 4-20.) WWC FOF 69.

1 167. In 1882, construction of the Spreckels Ditch started. (Exh. D-48; Chumbley, Tr. 1/15/08,
2 p. 24, ll. 17-24.) WWC FOF 70.

3 168. Around 1900, construction of the `Īao and Waiehu ditch systems was started. (Exh. D-
4 48; Chumbley, Tr. 1/15/08, p. 24, l. 25 to p. 26, l. 8). WWC FOF 71.

5 169. Construction of the Waihe`e Ditch started in 1905 and was completed in two years. (Exh.
6 D-48; Chumbley, Tr. 1/15/08, p. 25, ll. 17-25.) WWC FOF 72.

7 170. The WWC distribution system involves 11 registered stream diversions, 2 major ditches,
8 7 minor ditches, and 16 reservoirs. (Suzuki, WDT 9/12/07, pp. 2-3; Exh. D-1(A); Exh. D-1(B);
9 Chumbley, WDT 9/12/07, p. 3; Exh. C-85, pp. 9:12 -10:10.) WWC FOF 75.

10 171. In addition to sharing in the cost and maintenance of the portions of the system operated
11 by WWC, HC&S operates a diversion intake on South Waiehu Stream at the Spreckels Ditch, a
12 diversion intake on `Īao Stream at the Spreckels Ditch, and the Spreckels Ditch from Reservoir
13 25 to its terminus at HC&S's Reservoir No. 73 (the "Waiale Reservoir"). (Hew, WDT 1/29/08.)
14 HC&S FOF 7.

15 172. The distribution system from the Nā Wai `Ehā streams, including intakes, reservoirs,
16 connectors, kuleana systems and gauging stations, is depicted in Figure 5, which combines
17 Figures 1-4 and, while generally correct, has some inaccuracies in placements of reservoirs and
18 kuleana systems. (Exh. D-99.) WWC FOF 78.

19 173. WWC distributes water to three major user groups: agricultural, kuleana systems, and
20 domestic. (Chumbley, WDT 9/12/07, pp. 6-7.) WWC FOF 77.

21 174. WWC's system is divided into northern and southern sections. (Suzuki, WDT 9/12/07, p.
22 3.) WWC FOF 79.

23 175. The northern sector of the system includes the Waihe`e, Spreckels, North Waiehu, and
24 `Īao-Maniania ditches, which receive water from the Waihe`e, North Waiehu, and `Īao Streams.
25 (Suzuki, WDT 9/12/07, p. 3.) WWC FOF 81.

26 176. The southern section of the system includes the South Waikapū, Reservoir No. 6, and
27 `Īao-Waikapū Ditches, which divert water from the Waikapū and `Īao Streams. (Suzuki, WDT
28 9/12/07, p. 3; Chumbley, Tr. 1/14/08, p. 32, l. 22 to p. 33, l. 2; Suzuki, Tr. 12/14/07, p. 79, l. 25;
29 Exh. D-99B.) WWC FOF 80. HC&S FOF 25.

30 177. There are two major ditches in the system: the Waihe`e and Spreckels Ditches. (Suzuki,
31 WDT 9/12/07, pp. 2-4; Exh. D-1A; Exh. D-99.) WWC FOF 82.

1 **1. Waihe`e Ditch**

2 178. The Waihe`e Ditch begins at the Waihe`e Ditch Diversion in Waihe`e Stream and
3 terminates at Reservoir 9. (Suzuki WDT 9/12/07, pp. 3-4; Exh.. D-1(A); Exh. D-99; Exh. D-45).
4 WWC FOF 83.

5 179. The Waihe`e Ditch diversion on Waihe`e Stream is at approximately 620 feet elevation
6 and consists of two concrete structures that direct stream flow over metal grates that drop water
7 into the intake. (Exh. E-53, p. 23.) WWC FOF 103.

8 180. The Waihe`e Ditch Intake has a design capacity of 60 mgd but is set to divert 40 mgd.
9 (Suzuki, WDT 9/12/07, p. 4.) WWC FOF 26. HC&S FOF 10.

10 181. There is an additional intake into the Waihe`e Ditch at Waikapū Stream. (Chumbley, Tr.
11 1/15/08, p. 29, l. 10-14, p. 30, l. 6-10; Exh. D-99B.) HC&S FOF 11.

12 182. Water from the Waihe`e Ditch can be transferred to the Spreckels Ditch in two places: 1)
13 a “drop” ditch in Waihe`e Valley located north of all reservoirs, which transfers approximately 6
14 mgd into the Spreckels Ditch (Suzuki, WDT 9/12/07, p. 3, ll. 20-21.) HC&S FOF 12; and 2)
15 through the Hopoi Chute located near `Īao Stream, which transfers water into the Spreckels
16 Ditch at its terminus at Waiale Reservoir.

17 183. Water can also be added to the Waihe`e Ditch from North Waiehu Stream via the North
18 Waiehu Ditch and from `Īao Stream via the `Īao-Maniania and `Īao-Waikapu Ditches. (**See** FOF
19 194, 197, 198, *infra.*)

20
21 **2. Spreckels Ditch**

22 184. The Spreckels Ditch starts at its intake on Waihe`e Stream at 420 feet elevation
23 (downstream from the Waihe`e Ditch intake), crosses North Waiehu Stream, South Waiehu
24 Stream, and `Īao Stream, and terminates at the point where the Hopoi chute drops water from the
25 Waihe`e Ditch to HC&S’s Waiale Reservoir. (Chumbley, Tr. 1/15/08, p. 30, ll. 11-18; Suzuki,
26 WDT 9/12/07, pp. 3-5; Exh. D-99B; Exh. E-53, p. 4.) WWC FOF 108. HC&S FOF 13.

27 185. The Spreckels Ditch intake at Waihe`e Stream has a design capacity of 30 mgd, but the
28 gate is typically set at 12 mgd. The intake is controlled by WWC. (Chumbley, Tr. 1/15/08, p. 30,
29 ll. 11-18; Suzuki, WDT 9/12/07, p. 5, ll. 6-7; Suzuki, Tr. 12/14/07, p. 74, ll. 14-16; Exh. D-99B.)
30 HC&S FOF 14.

1 186. The Spreckels Ditch also has intakes at South Waiehu Stream and `Īao Stream, which are
2 controlled by HC&S. (Chumbley, Tr. 1/15/08, p. 31, ll. 2-11; Exh. D-99B.) HC&S FOF 15.

3 187. HC&S's intakes are not metered, but HC&S estimates that the intake on South Waiehu
4 Stream ranges from a low of 2-3 mgd during dry periods to a maximum of 10-15 mgd during wet
5 periods. There is also a kuleana intake via a pipe that takes water from the ditch that connects the
6 diversion to Spreckels Ditch, which HC&S estimates takes approximately 0.25 mgd. (Hew,
7 WDT, 1/29/08, ¶ 11C; Hew, Tr. 1/28/08, p. 32, l. 8 to p. 33, l. 9.) HC&S FOF 88C.

8 188. The intake on `Īao Stream is also not metered, but HC&S estimates that the amount
9 diverted ranges from a low of 3-4 mgd during dry periods to a high of about 20 mgd during wet
10 periods. (Hew, WDT 1/29/08, ¶ 11E.) HC&S FOF 88E.

11 189. HC&S's `Īao Tunnel (Well No. 5330-02), for which it has a WUPA for 0.1 mgd, enters
12 the Spreckels Ditch between the intakes from South Waiehu and `Īao Streams. (Hew, WDT
13 1/29/08, ¶ 11D.) HC&S FOF 88D.

14 190. HC&S measures the aggregate water flow in the Spreckels Ditch at its Wailuku gauging
15 station located downstream of the South Waiehu Diversion, the intake pipe from the HC&S `Īao
16 Tunnel, and the `Īao Stream intake, none of which is separately gauged. In addition to these three
17 sources, the gauged amount includes water diverted by WWC from Waihe`e River via two
18 ditches: 1) the Waihe`e Ditch via the drop ditch to Spreckels Ditch; and 2) the Spreckels Ditch,
19 downstream from the Waihe`e Ditch diversion. (Hew, WDT 1/29/08, ¶ 11F.) HC&S FOF 88F.

20 191. As described under the Waihe`e Ditch, water can be transferred from the Waihe`e Ditch
21 to the Spreckels Ditch through a drop ditch and the Hopoi Chute. (**See** FOF 182, 184, *supra*).

22 192. WWC controls the Spreckels Ditch from its intake on Waihe`e Stream to HC&S's intake
23 at South Waiehu Stream, and HC&S controls the Ditch from South Waiehu to its terminus at
24 Waiale Reservoir. (**See** FOF 171, *supra*.)

25

26 **3. North Waiehu Ditch**

27 193. The North Waiehu Ditch on North Waiehu Stream has a capacity of 5 mgd, but the
28 control gate is currently set at 1.5 mgd. (Chumbley, Tr. 1/14/08, p. 32, ll. 14-17; Suzuki, WDT
29 9/12/07, p. 4, ll. 9-10 and p. 5, ll. 11-12.) HC&S FOF 22.

1 194. The North Waiehu Ditch diverts water to the north and can drop water into the Waihe`e
2 Ditch. (Chumbley, Tr. 1/14/08, p. 32, ll. 14-17; Suzuki, Tr. 12/14/07, p. 76, ll. 7-11.) HC&S FOF
3 23.

4 **4. Īao Ditch**

5 195. The Īao Ditch starts with an intake at Īao Stream, which has a capacity of 60 mgd, but a
6 control gate in the Ditch after the intake is set to divert at most 20 mgd. (Suzuki, WDT 9/12/07, p.
7 4, ll. 3-8, and p. 5, ll. 8-9; Chumbley, Tr., 1/14/08, p. 31, ll. 16-22.) HC&S FOF 19.

8 196. The gate controls the amount of water that diverted north to the Īao-Maniania Ditch or
9 south to the Īao-Waikapū Ditch. Any water beyond the gate settings for the Īao-Maniania and
10 the Īao-Waikapū ditches is returned to Īao Stream about 1000 feet below the intake. The
11 settings for this control gate vary according to needs, and are changed as often as weekly. HC&S
12 gives WWC a weekly plan of their irrigation needs by day and reservoirs so that WWC can
13 adjust the control gate accordingly. (Suzuki, WDT 9/12/07, p. 4, ll. 3-8, p. 5, ll. 8-9, p. 41, ll. 3-8;
14 Suzuki, Tr. 12/14/07, p. 77, ll. 21-25, and p. 174, l. 18 to p. 175, l. 12; Chumbley, Tr. 1/14/08, p.
15 31, ll. 16-22; Chumbley, Tr. 1/16/08, p. 134, ll. 2-17 and p. 190, l. 9 to p. 191, l. 18; Exhibit D-
16 99B.) HC&S FOF 19. MDWS FOF 80.

17 197. The Īao-Maniania Ditch is an unlined ditch of about 2.07 miles in length. It has a rated
18 capacity of 30 mgd, but its control gate is currently set to receive 2 mgd of flow from the main
19 Īao Ditch. The Īao-Maniania Ditch can deliver water back north and deposit water back into
20 the Waihe`e Ditch. (Chumbley, Tr. 1/14/08, p. 31, ll. 23-24 and p. 32, ll. 7-8; Suzuki, Tr.
21 12/14/07, p. 7, ll. 1-4; Suzuki, WDT 9/12/07, p. 5, ll. 9-10; Exh. D-99B.) HC&S FOF 20.

22 198. The Īao-Waikapū Ditch is approximately 70 to 80 percent lined and is 2.95 miles in
23 length. It has a rated capacity of 30 mgd, but its control gate is currently set to receive 18 mgd of
24 flow from the main Īao Ditch. The Īao-Waikapū ditch can send water south to service the
25 Waikapū region and the area from Īao Valley Road back to the south. (Chumbley, Tr. 1/14/08,
26 p. 31, ll. 16-22, and p. 32, ll. 1-10; Suzuki, WDT 9/12/07, p. 5, ll. 9-10; Suzuki, Tr. 12/14/07, p.
27 78, ll. 5-7; Exh. D-99B.) HC&S FOF 21. Any water remaining in the Īao-Waikapū Ditch is put
28 into the Waihe`e Ditch downstream of the Hopoi Chute. (Hew, WDT 1/29/08, ¶ 10C.) HC&S
29 FOF 87C.

30

31

1 **5. Waikapū Ditch**

2 199. The Waikapū Ditch is located off of the top intake on Waikapū Stream (the other two
3 intakes on Waikapū Stream are at the Waihe`e Ditch (**See** FOF 181, *supra*) and at the Reservoir
4 No. 6 Ditch (**See** FOF 200, *infra*). The intake to the ditch has a rated capacity of 5 mgd, but the
5 control gate is currently set at 3 mgd. The ditch delivers water to Reservoir No. 1. (Chumbley,
6 Tr. 1/14/08, p. 32, ll. 18-21; Suzuki, WDT 9/12/07, p. 4, ll. 11-12 and p. 5, ll. 10-11; Exhibit D-
7 99B.) HC&S FOF 24.

8
9 **6. Reservoir No. 6 Ditch**

10 200. The Reservoir No. 6 Ditch delivers water from the lowest Waikapū Stream intake and
11 delivers it back north to Reservoir No. 6, located just below Honoapiilani Highway. (Chumbley,
12 Tr. 1/14/08, p. 32, l. 22 to p. 33, l. 2; Suzuki, Tr. 12/14/07, p. 79, l. 25; Exhibit D-99B.) HC&S
13 FOF 25.

14
15 **7. Inactive Ditches**

16 201. The Kama Ditch, Everett Ditch, and Field One intake are inactive ditches. (Chumbley,
17 Tr. 1/14/08, p. 33, ll. 7-12; Suzuki, Tr., 12/14/07, p. 74, ll. 16-17, p. 77, l. 25, and p. 79, l. 23;
18 Exh. D-99B.) HC&S FOF 26.

19
20 **8. Monitoring Practices**

21 202. WWC maintains a “storm setting” practice when heavy rains are forecasted. (Suzuki,
22 WDT 9/12/07, pp. 11-12.) WWC FOF 117.

23 203. At storm settings the Waihe`e Ditch Gate on Waihe`e Stream will be reduced to 20 mgd
24 from the normal setting of 40 mgd, and the `Īao-Waikapū Ditch Gate will be reduced to 10 mgd
25 from 18 mgd. (Suzuki, WDT 9/12/07, pp. 11-12.) WWC FOF 119.

26 204. The primary intakes of the Waihe`e, Spreckels, `Īao-Maniania, and `Īao-Waikapū ditches
27 have 24-hour gauging stations to measure the ditch flow. In addition, ditch flows at five other
28 stations along the six ditches operated by WWC are read and recorded daily. (Suzuki, WDT
29 9/12/07, p. 4.) WWC FOF 94, 95.

30 205. The waters that enter the distribution system travel by gravity flow in primary ditches
31 through uplands into reservoirs that in turn deliver the water into smaller ditches for end use.

1 Because the flows of the streams vary daily, reservoirs were made a part of the system to allow
2 for a more constant delivery of water to end users. (Suzuki, WDT 9/12/07, pp. 5-8.) WWC FOF
3 120, 121.

4 206. WWC built and presently maintains 16 reservoirs that were designed to hold about 79
5 million gallons, but due to siltation, the reservoirs have a current capacity between 55 and 60
6 million gallons. (Suzuki, WDT 9/12/07, pp. 5-6.) WWC FOF 122, 123.

7 207. Each reservoir has a water meter to measure the flow from the reservoir. (Suzuki, WDT
8 9/12/07, p. 6.) WWC FOF 125.

9 208. In addition to their stream diversions, both WWC and HC&S add or may augment stream
10 waters with other sources. WWC adds water from its and MDWS's `Īao Tunnel at the `Īao
11 Stream intake (See Figure 3), and HC&S adds water from its `Īao Tunnel into the portion of the
12 Spreckels Ditch that it controls (See FOF 189, *supra*). In the past, HC&S has also used its Well
13 No. 7 to pump ground water from the Kahului aquifer to irrigate some of its fields. (Volner,
14 WDT 9/14/07, p. 2; Volner, Tr. 1/29/08, pp. 175-177.) WWC FOF 149.

15

16 **G. Users**

17

18 209. Historically, an average of about 67 mgd was diverted from the four streams for sugar
19 cane irrigation: 40 mgd from Waihe`e, 3 mgd from North Waiehu, 3 mgd from South Waiehu,
20 18 mgd from `Īao, and 3 mgd from Waikapū. (Oki, WDT 9/14/07, ¶ 18; Exh. A-5, p. 8; Exh. A-3,
21 p. 13.)

22 210. Currently, from 70 to 90 percent of the annual total flow of Waihe`e River is diverted by
23 WWC. (Suzuki, WDT 9/12/07, p. 10.) WWC FOF 408. WWC estimates that the amount of
24 water diverted averaged 37.09 mgd in 2005 and 29.72 mgd in 2006. (Exh. A-138.) WWC FOF
25 412.

26 211. Currently, from 40 to 60 percent of the annual total flow of North Waiehu Stream is
27 diverted by WWC. (Suzuki, WDT 9/12/07, p. 10.) WWC FOF 653. WWC estimates that the
28 amount it diverts averaged 1.41 mgd in 2005 and 1.38 mgd in 2006. (Exh. A-138; Exh. A-213.)
29 WWC FOF 655. In addition, HC&S estimates that the amount it diverts at its intake on South
30 Waiehu Stream into the Spreckels Ditch ranges from a low of 2-3 mgd during dry periods to a
31 maximum of 10-15 mgd during wet periods. (Hew, WDT, 1/29/08, ¶ 11C; Hew, Tr. 1/28/08, p.
32 32, l. 8 to p. 33, l. 9.) HC&S FOF 88C.

1 212. Currently, from 30 to 50 percent of the annual total flow of `Īao Stream is diverted by
2 WWC. (Suzuki, WDT 9/12/07, p. 10.) WWC FOF 536. WWC estimates that the amount of
3 water diverted averaged 13.68 mgd in 2005 and 13.53 mgd in 2006. (Exh. A-138.) WWC FOF
4 542. In addition, HC&S estimates that the amount it diverts at the Spreckels Ditch ranges from a
5 low of 3-4 mgd during dry periods to a high of about 20 mgd during wet periods. (Hew, WDT
6 1/29/08, ¶ 11E.) HC&S FOF 88E.

7 213. Currently, from 60 to 80 percent of the annual total flow of Waikapū Stream is diverted.
8 (Suzuki, WDT 9/12/07, p. 10.) WWC FOF 754. WWC estimates that the amount of water
9 diverted averaged 4.32 mgd in 2005 and 4.31 mgd in 2006. (Exh. D-7; Exh. A-138.) WWC FOF
10 758.

11
12 **1. The Kuleana Systems**

13 214. Before the 1980s, delivery of water to most kuleana systems only occurred during periods
14 when water was delivered for agricultural operations through the ditches and reservoirs to which
15 the kuleana systems were connected. (Suzuki, Tr. 12/14/07, p. 89; Chumbley, Tr. 1/15/08, pp.
16 39- 40.) WWC FOF 154.

17 215. In the 1980s, as WWC shifted from furrow irrigation to drip irrigation, WWC changed its
18 delivery system by installing pipes to replace ditches, which made deliveries more reliable and
19 consistent. (Suzuki, Tr. 12/14/07, p. 89; Chumbley, Tr. 1/16/08, p. 142.) WWC FOF 155.

20 216. During plantation operations, HC&S and WWC frequently provided the maintenance of
21 the kuleana systems when their workers maintained the ditch systems used to provide irrigation
22 for agricultural operations of those companies. (Chumbley, Tr. 1/15/08, pp. 39-40.) WWC FOF
23 157.

24 217. After the installation of drip irrigation in the 1980s, users of the kuleana systems which
25 received water through the WWC distribution system were expected to maintain their own
26 systems. (Chumbley, Tr. 1/15/08, pp. 39-40.) WWC FOF 158.

27 218. WWC's practice since that time has been and remains that it will maintain its ditches to
28 the point of delivery of water into the kuleana ditch or pipe system. (Suzuki, WRT 10/29/07, p.
29 9.) WWC FOF 159.

30 219. Maintenance of the kuleana ditches and pipes by the present users has been inconsistent,
31 with some users maintaining limited portions of some of the systems and other systems receiving

1 no maintenance from the users. (Suzuki, Tr. 12/14/07, p. 142; Miyashiro, Tr. 2/21/08, pp. 189-
2 192). WWC FOF 161.

3 220. Seventeen kuleana ditch/pipe systems were identified (but there may be 18; see FOF 225,
4 *infra*). (Exh. D-99.) WWC FOF 151.

5 221. Table 1 lists each kuleana ditch/pipe system and the source of water for the system.
6 Fourteen systems are connected to one of the primary distribution systems, and three divert water
7 directly from a stream. (Exh. D-7; Cerizo WDT 9/14/07; Pellegrino WDT9/14/07; Duey
8 WDT9/14/07; Exh. D-99.) WWC FOF 152.222.

9 222. Table 2 lists the amount of water delivered to each of the kuleana ditches/pipes that
10 receive water through the WWC distribution system in 2006. (Exh. D-7, Exh. A-213.) WWC
11 FOF 413, 543, 657, 759.

12 223. WWC states that the Field 31 Pipe off the Spreckels Ditch is not metered and therefore
13 provided no figures. (Exh. D-7; Exh. A-213.) WWC FOF 657.

14 224. Hui/MTF claims that there is a branch `auwai to Waihe`e Valley North `auwai, and that
15 the 0.95 mgd measurement does not include 0.43 mgd measured in this branch in September
16 2007. (Ellis, WDT 10/26/07, ¶ 6.) Hui/MTF FOF D-27.

17 225. As described earlier, at HC&S's diversion on South Waiehu Stream, there is also a
18 kuleana intake via a pipe that takes water from the ditch that connects the diversion to Spreckels
19 Ditch, which HD&S estimates takes approximately 0.25 mgd. (Hew, WDT, 1/29/08, ¶ 11C; Hew,
20 Tr. 1/28/08, p. 32, l. 8 to p. 33, l. 9.) HC&S FOF 88C. This kuleana pipe diversion is very close
21 to the Field 31 Pipe off the Spreckels Ditch (See Figure 2), and both HC&S and WWC may be
22 referring to the same ditch. If so, then the Field 31 pipe diverts about 0.25 mgd; if not, then the
23 amount diverted by the Field 31 pipe remains unknown and there are at least 15, not 14, kuleana
24 ditch/pipe systems in addition to the three diversions that have been identified as diverting water
25 directly off South Waiehu, `Iao, and Waikapū streams.

26 226. The three diversions on the streams are not measured. (Duey, Tr. 12/3/07, p. 66; Cerizo,
27 Tr. 12/7/07, pp. 69-84; Pellegrino, Tr. 12/6/07, p. 266, ll. 10-15.) WWC FOF 539, 622.

28 227. The total identified amount of water diverted for kuleana use is therefore probably 6.84
29 mgd, 0.68 mgd more than the 6.16 mgd reported by WWC in Table 2. The 6.84 mgd does not
30 include the amount diverted by the Field 31 pipe and the amounts diverted directly from South

1 Waiehu, `Īao, and Waikapū Streams by the three known diversions and other, unknown
2 diversions.

3 228. WWC does not measure amounts of water delivered to or collect data on the individual
4 users from kuleana systems on a parcel-by-parcel basis. (Chumbley, WDT 9/12/07, p. 10.) WWC
5 FOF 173.

6 229. Table 3 identifies persons receiving water from a kuleana distribution system that
7 delivers Waihe`e River water. (Exh. D-7.) WWC FOF 414.

8 230. Table 4 identifies persons receiving water from a kuleana distribution system that
9 delivers North Waiehu Stream water. (Exh. D-7; Hoopi, Tr. 12/4/07, pp. 196-207; Singer, Tr.
10 12/13/07, p. 29.). WWC FOF 658.

11 231. Table 5 identifies persons receiving water from a kuleana distribution system that
12 delivers `Īao Stream water. (Exh. D-7; Brito, Tr 12/7/07, pp. 29-38.) WWC FOF 544.

13 232. Table 6 identifies persons receiving water from a kuleana distribution system that
14 delivers Waikapū Stream water. (Exh. D-7; Exh. A-194.). WWC FOF 761.

15 233. Nearly 50 persons testified at the CCH, including many identified in Tables 3-6 and
16 others who wished to receive Na Wai `Ehā waters. Approximately 135 acres were involved, of
17 which about 45 acres were or were intended to be cultivated, primarily in wetland kalo but also
18 for vegetables, trees, and plants for subsistence and cultural purposes. (See Hui/MTF FOF D-1 to
19 D-458).

20 234. Persons who were receiving water testified that the amounts currently delivered were
21 insufficient (e.g., Pellegrino, WDT 9/14/07, ¶¶ 17-18; Hui/MTF FOF D-389, D-398) and nearly
22 all also wished to increase their land under cultivation (e.g., Soong, WDT 11/16/07, ¶¶ 4-5;
23 Hui/MTF FOF D-379-D-380). Most of those not receiving water intended to resume or start
24 cultivation of a portion of their land (e.g., Ornellas, WDT 9/14/07, ¶¶ 8, 16) Hui/MTF FOF D-
25 308, but several asked only for stream restoration for cultural and recreational purposes (e.g.,
26 Higashino, WDT 9/14/07, ¶¶ 6-7; Higashino, Tr. 12/13/07, p. 8, ll. 10-19, p. 9, ll. 7-12)
27 Hui/MTF FOF D-156, D-157.

28 235. Most of those testifying had lands under 5 acres, but some had larger parcels; e.g., Duey,
29 on `Īao Stream with 18.146 acres, of which he currently has only 0.08 acres in kalo lo`i but
30 intended to reopen all 1.5 acres of ancient lo`i if water were available (J. Duey, WDT 9/14/07, ¶¶
31 3, 11-12, 14), Hui/MTF FOF D-284, D-288, D-289; Horcajo, with 49.5 acres, of which he would

1 start with 3 acres of kalo lo`i and 4 acres of native plants (Horcajo, WDT 9/14/07, ¶¶ 5, 12, 14),
2 Hui/MTF FOF D-313, D.316, D-317.

3 236. At least one person leased lands for commercial growing of kalo; Ho`opi`i, with 3.94
4 acres, of which 3.5 acres has been leased to Aloha Poi for over 50 years. (Ho`opi`i WDT
5 10/26/07, ¶¶ 4, 16.) Hui/MTF FOF D-180, D-185.

6 237. In addition to the mostly small parcels of land that comprised the approximately 135
7 acres, North Shore at Waiehu, with 64 acres of land along the shore near Waiehu and `Īao
8 Streams, requested stream flow restoration so that springs would revive and help restore the
9 wetlands that previously comprised about one-third of the property. (Ivy, WDT 3/7/08, ¶¶ 1-2, 9-
10 10, 17-18.) Hui/MTF FOF D-358, D-364.

11

12 2. MDWS

13 238. In addition to water from the `Īao Tunnel (Well No. 5332-02), MDWS receives water
14 from the `Īao-Waikapū Ditch, which is treated at its `Īao Water Treatment Facility for domestic
15 use. (Eng, Dec. 9/14/07, p. 8.) WWC FOF 190.

16 239. In June 2004 MDWS and WWC entered into an agreement until November 2007,
17 extended to February 2008, allowing MDWS to receive up to 3.2 mgd from the `Īao-Waikapū
18 Ditch, with a fixed transportation fee of \$0.48 per thousand gallons. (Exhs. B-14, B-23, D-8(i),
19 and D-93.)

20

21 3. WWC Delivery Agreements

22 240. WWC has water-delivery agreements with 34 entities in addition to its agreement with
23 MDWS and HC&S. (Exh. D-96.)

24 241. WWC's table of customers does not identify the nature of the water uses, except to label
25 them generally as either "agriculture" or "irrigation." Under WWC's terminology, "irrigation" is
26 "agriculture," but on a shorter-term basis and also includes dust control. (Exh. D-96; Chumbley,
27 Tr. 1/24/08, p. 64, l. 21 to p. 65, l. 13.) Hui/MTF FOF E-31.

28 242. WWC's table of customers also did not provide information on any acreages cultivated.
29 (Exh. D-96.) Hui/MTF FOF E-32.

30 243. Several of WWC's customers provided testimony at the CCH:

1 244. Maui Cattle Company (“MCC”), with a maximum delivery agreement of 0.750 mgd (Exh.
2 D-96), previously irrigated pasture for cattle on an experimental basis, using up to 0.9 to 1 mgd
3 to spray water into the air over dry pasture. (Franco, Tr. 1/14/08, p. 174, ll. 22-24, p. 176, ll. 17-
4 19, and p. 188, ll. 23-25.) Hui/MTF FOF E-40, E-41, E-42.

5 245. The irrigated area subsequently was decreased from 240 to 25 acres, the number of cattle
6 decreased from a high of 375 to 60, and the amount of water decreased to about 0.029 mgd by
7 2007. (Franco, Tr. 1/14/08, p. 176, l. 4, p. 186, ll. 8-11 and 19-22, p. 192, ll. 6-14.) Hui/MTF
8 FOF E-48, E-49.

9 246. MMK Maui (“MMK”), with a maximum delivery agreement of 4 mgd (Exh. D-96), used
10 1.198 mgd for 36 holes in 2006, its first full year of irrigation. (Dooge, Tr. 1/14/08 p. 136, ll. 9-
11 13 and p. 160, ll. 9-22.) Hui/MTF FOF E-59.

12 247. Wailuku Country Estates (“WCE”), with a maximum delivery agreement of 1 mgd (Exh.
13 D-96), was represented by a single lot owner, who did not identify the total current use by WCE.
14 WCE limits each lot owner to a daily average of 2,200 gallons (“gpd”) and imposes an extra
15 charge for any excess over the allowable use. (Irani, Tr. 1/14/08, p. 18, ll. 10-15, p. 91, l. 25 to p.
16 92, l. 3; Exh A-214, p. 1.) Hui/MTF FOF E-85, E-86.

17 248. WCE lots also receive up to 540 gpd from the county water system.

18 249. WCE also claimed a maximum amount of 0.1 mgd for its community park and roadside
19 community areas (acreage not specified) but on cross-examination stated that actual use was less
20 than half of the stated maximum. (Irani, Dec. 9/14/07, ¶ 7; Irani, Tr. 1/14/08, p. 55, l. 22 to p. 56,
21 l. 1 and p. 55, ll. 2-3.) Hui/MTF FOF E-91, E-92.

22 250. Koolau Cattle Company (“KCC”), a 10-lot, 72-acre agricultural development with a
23 maximum delivery agreement of 0.1 mgd (Exh. D-96), provided no details on acreages or water
24 usages. (Betsill, Tr. 1/25/08, p.210, ll. 18-23.) Hui/MTF FOF E-99.

25 251. Each lot in KCC also receives up to 1,000 gpd from the county system. (Betsill, Tr.
26 1/25/08, p. 204, l. 24 to p. 205, l. 5.) Hui/MTF FOF E-98.

27 252. Atherton and his partners (“Atherton et al.”) own several entities, including Ma`alaea
28 Properties, Waikapū Properties, and Maui Tropical Plantation (“MTP”). MTP has a maximum
29 delivery agreement of 0.5 mgd. (Exh. D-96.) Ma`alaea Properties and Waikapū Properties each
30 have maximum delivery agreements of 0.050 mgd. (Exh. C-71, p. 2, §§ 1.09, 3.01; Exh. C-72, p.

1 2, §§ 1.09, 3.01; Atherton, Tr. 2/21/08, p. 165, l. 8 to p. 166, l. 12; Exh. D-96.) Hui/MTF FOF E-
2 131.

3 253. Maui Tropical Plantation used 0.114 mgd for 59 acres over the period 2001 through 2007.
4 (Ex. A-140, p. 20; D-97; Atherton, Tr. 2/21/08, p. 180, ll. 1-11.) Hui/MTF E-124.

5 254. The Ma`alaea development project is still “a long ways” away and “all proposed...not
6 fact.” (Atherton, Tr. 2/21/08, p. 134, ll. 15-20 and p. 143, ll. 11-17.) Hui/MTF FOF E-117.

7 255. A coffee plantation is proposed for the Waikapū Properties. (Atherton, Tr. 2/21/08, p. 168,
8 l. 23 to p. 169, l. 15; p. 171, ll. 1-4; p. 203, ll. 19-22; p. 169, ll. 18-20.) Hui/MTF FOF E-120.

9 256. The maximum delivery agreements derived from Exh. D-96 and D-99 total 11.188 mgd
10 (not including MDWS, which has a maximum-use agreement of 3.2 mgd (See FOF 239, *supra*.)
11 However, other evidence introduced at the CCH (See FOF 252, *supra*) show that Ma`alaea and
12 Waikapū Properties each have maximum delivery agreements of 0.05 mgd, not 1.0 mgd as
13 shown for Ma`alaea Properties and 2.0 mgd as shown for Waikapū Properties in Exh. D-96. (See
14 also WWC FOF 421, 553, 767, which are derived from Exh. D-96 and Exh. D-99.)

15 257. Therefore, the maximum delivery agreements that WWC has with 34 entities total 8.288
16 mgd, not 11.188 mgd ($11.188 - 0.95 - 1.95 = 8.288$).

17 258. The total amounts of water used under the 34 water-delivery agreements were 1.42 mgd
18 in 2005 and 2.37 mgd in 2006. (Exh. E-3; Exh. E-4; Exh. A-138.) WWC FOF 270.

19

20 4. HC&S

21 259. In addition to water from its diversions on South Waiehu and `Īao Streams and from the
22 `Īao Tunnel that feed into the Spreckels Ditch, HC&S receives water from WWC through the
23 Spreckels Ditch (from Waihe`e River), the Waihe`e Ditch via the drop ditch into Spreckels Ditch
24 (also from Waihe`e River), and the Hopoi Chute into the terminus of the Spreckels Ditch (from
25 Waihe`e River and North Waiehu and `Īao Streams). (Hew, WDT 1/29/08, pp. 4-6.) WWC FOF
26 148.

27 260. The portion of HC&S' plantation that is irrigated with Nā Wai `Ehā stream water consists
28 of two groups of fields: 1) the Waihe`e-Hopoi Fields, and the `Īao-Waikapū fields. (Exh. E-1.)

29 261. The Waihe`e-Hopoi Fields consist of 3,950 acres, excluding the 300 acres of Fields 921
30 and 922, which in recent years have been irrigated exclusively with wastewater from Maui Land
31 and Pine (“MLP”). HC&S anticipates that, due to the shutdown of MLP's cannery operation,

1 MLP mill wastewater will only be able to supply approximately half of the irrigation
2 requirements of Fields 921 and 922 in the future.² HC&S owns the Waihe‘e-Hopoi Fields. (Exh.
3 E-1); Hew, WDT 1/29/08, ¶ 5; Volner, WDT 9/14/07, ¶¶ 3, 5; Volner, Tr. 1/29/08, p. 163, ll. 1-
4 16 and p. 174, l. 2 to p. 175, l.14.) HC&S FOF 79.

5 262. These fields are currently irrigated with Nā Wai ‘Ehā stream water transported to Waiale
6 Reservoir, from where it is distributed by gravity flow via pipes and ditches to sand filter stations
7 for removal of impurities and then applied to the fields through drip tubes. (Volner, WDT
8 9/14/07, ¶ 11; Hew, WDT 1/29/08, ¶ 5.) In addition, HC&S Well No. 7, which is the only one of
9 HC&S’s 16 brackish water wells on the plantation that is situated so as to be able to introduce
10 water into HC&S’s internal ditch system and direct it by gravity flow, can also be used to irrigate
11 the Waihe‘e-Hopoi fields with the exception of Field 715. (Volner, WDT 9/14/07, ¶ 6.) HC&S
12 FOF 80.

13 263. HC&S has minimized the use of Well No. 7 ever since Brewer ceased its sugar
14 operations and the Waihe`e and Spreckels Ditch flows previously used by Brewer to irrigate its
15 cane fields were allowed to flow uninterrupted into the Waiale Reservoir 24 hours a day rather
16 than being substantially reduced during the day, as was previously the case under the sharing
17 arrangement between HC&S and Brewer. (Volner, WDT 9/14/07, ¶ 7.) HC&S FOF 80.

18 264. The `Īao-Waikapū fields (also known as the “Leased Fields”) consist of 1,350 acres.
19 HC&S leases all of these fields except Field 920, which HC&S owns. Historically, the `Īao-
20 Waikapū Fields were cultivated by C. Brewer and successor entities. After C. Brewer terminated
21 its sugar operations, HC&S took over cultivation of these fields by taking back Field 920 and
22 leasing the remaining fields from C. Brewer. HC&S currently leases the fields from the Atherton
23 Group. (Hew, WDT 1/29/08, ¶ 6; Hew, Tr. 1/29/08, p. 115, ll. 20-23; Volner, WDT 9/14/07, ¶ 3;
24 Holaday, Tr. 1/31/08, p. 68, l. 21 to p. 69, l. 9; Exh. E-1; Exh. C-67.) HC&S FOF 81.

25 265. The Atherton Group consists of LODI Development, Inc., Michael W. Atherton, William
26 S. Fillios, as trustee of the William Fillios Separate Property Trust dated April 3, 2000, and

² The Commission takes judicial notice that, after the close of the evidentiary portion of the contested case, MLP announced that it will cease all of its pineapple operations and that therefore, no wastewater will be available from MLP. “Pineapple Pau, Maui Pine to shut down by end of year,” **Maui News**, Wednesday, November 4, 2009. Revival of the fresh fruit operations by Haliimaile Pineapple Co., “Pineapple Revival,” **Honolulu Star Bulletin**, Sunday, January 3, 2010, pp. 6-7, should not result in restoration of this wastewater source.

1 Boyce Holdings, Inc. Michael Atherton testified that he intends to renew the six-year lease with
2 HC&S for the portions of the ‘Īao-Waikapū Fields owned by the Atherton Group. (Atherton, Tr.
3 2/21/08, p. 208, ll. 17-22.) HC&S FOF 81.

4 266. The ‘Īao-Waikapū Fields are all above the Waiale Reservoir, and thus, beyond the reach
5 of HC&S’ gravity-based irrigation system, including Well No. 7. These fields are irrigated with
6 water from WWC’s Reservoir 6, which can receive water from ‘Īao-Waikapū Ditch via the
7 Waihe‘e Ditch, the Waihe‘e Ditch below the Hopoi chute, and the South Waikapū Ditch. Water
8 to irrigate the ‘Īao-Waikapū Fields comes principally from ‘Īao Stream via the ‘Īao-Waikapū
9 Ditch and Waikapū Stream via the South Waikapū Ditch and Waihe‘e Ditch, all of which are
10 operated by WWC. If necessary, water in the Waihe‘e Ditch can be kept in the ditch past the
11 Hopoi chute to supplement the flow from the ‘Īao-Waikapū Ditch. Field 735, however, because
12 of its elevation, can only be irrigated with water from the South Waikapū Ditch. (Hew WDT
13 1/29/08, ¶¶ 6-8; Hew, Tr. 1/29/08, p. 89, ll. 18-22.) HC&S FOF 82.

14 267. HC&S intended to cultivate Field 767, a former Wailuku Sugar Company field that is
15 shown on Exhibit E-1 but not color coded. Rick W. Volner, Jr., HC&S’ Senior-Vice President
16 of Agricultural Operations, and G. Stephen Holaday, president of A&B’s Agricultural Group,
17 testified in January 2008, that HC&S intended to begin cultivation of the field within the next
18 two to three weeks. The source of irrigation water for Field 767 would be the same as the ‘Īao-
19 Waikapū Fields. (Volner, Tr. 1/30/08, p. 197, l. 10 to p. 198, l. 1, p. 198, ll. 6-13; Holaday, Tr.
20 1/31/08, p. 51, l. 21 to p. 52, l 17.) HC&S FOF 83.

21 268. Waiale Reservoir receives water from the Waihe‘e Ditch as follows:

22 269. Waihe‘e Ditch diverts Waihe‘e Stream via a stream diversion. WWC then drops an
23 amount of water determined by WWC to be necessary to service kuleanas in Waihe‘e Valley to
24 the Spreckels Ditch, from which it can be directed into the ditch that services the kuleanas.
25 (Hew, WDT 1/29/08, ¶ 10A.) HC&S FOF 87A.

26 270. North Waiehu Ditch diverts the northern tributary of Waiehu Stream. Water from the
27 North Waiehu Ditch is withdrawn by various kuleanas served by WWC. Any excess water
28 remaining in the ditch is fed into the Waihe‘e Ditch. (Hew, WDT 1/29/08, ¶ 10B.) HC&S FOF
29 87B.

30 271. WWC’s diversion at ‘Īao Stream channels water into the ‘Īao-Maniania Ditch to the north
31 and the ‘Īao-Waikapū Ditch to the south. WWC, via the ‘Īao-Maniania Ditch, services various

1 kuleanas and the Wailuku Country Estates subdivision. Any excess water remaining in the ‘Īao-
2 Maniania Ditch is put into the Waihe‘e Ditch. WWC, via the ‘Īao-Waikapū Ditch, services
3 various kuleanas, the Maui Department of Water Supply, and various licensees. Any excess
4 water remaining in the ‘Īao-Waikapū Ditch is put into the Waihe‘e Ditch downstream of the
5 Hopoi chute (and thus not available to Waiale Reservoir, because the Hopoi chute drops water at
6 the terminus of the Spreckels Ditch into Waiale Reservoir). (Hew, WDT 1/29/08, ¶ 10C.) HC&S
7 FOF 87C.

8 272. Water in the Waihe‘e Ditch is measured by HC&S at a gaging station at “Field 63” (this
9 is a former Brewer field designation) in Hopoi. The flow at the Hopoi gaging station represents
10 the aggregate of the remaining water in the ditch at that point collected in the Waihe‘e Ditch
11 from (a) Waihe‘e Stream; (b) any excess water passed from the North Waiehu Ditch; and (c) any
12 excess water passed from the ‘Īao-Maniania Ditch. The average flow measured at the Hopoi
13 gaging station between 1993 and 2007 was approximately 20.51 mgd. Approximately 100 yards
14 downstream of the gauging station, a control gate allows water in the Waihe‘e Ditch to be
15 diverted to the Hopoi chute Ditch and into the Waiale Reservoir. WWC operates and controls
16 the control gate. Pursuant to agreement with HC&S, WWC operates the control gate to divert
17 some or all of the Waihe‘e Ditch water into the Hopoi chute Ditch. Any water not diverted into
18 the Hopoi chute Ditch remains in the Waihe‘e Ditch. Water passing the Hopoi chute Ditch and
19 remaining in the Waihe‘e Ditch is under the control of WWC, and can be used to irrigate HC&S’
20 leased ‘Īao-Waikapū fields, Maui Tropical Plantation, and the golf course. (Hew, WDT 1/29/08,
21 ¶ 10D; Hew, Tr. 1/29/08, p. 120, ll. 8-13.) HC&S FOF 87D.

22 273. From approximately 1924 until Brewer stopped cultivating sugar in 1988, the Waihe‘e
23 Ditch water, which was comprised principally of water from Waihe‘e Stream, was shared by
24 agreement between Brewer and HC&S, 7/12 to Brewer and 5/12 to HC&S. From at least the mid
25 1980’s, this was administered by Brewer opening the gate to the Hopoi chute Ditch from 7:00
26 p.m. to 5:00 a.m. and closing it from 5:00 a.m. to 7:00 p.m. daily. However, after 1988, when
27 Brewer no longer needed the Waihe‘e Stream water downstream of the Hopoi chute, WWC has
28 generally left the gate open and the water formerly used by Brewer has flowed down into the
29 Waiale Reservoir for use by HC&S. (Hew, WDT 1/29/08, ¶ 10E.) HC&S FOF 87E.

30 274. Water delivered by WWC to HC&S’s Waiale Reservoir through the Hopoi Chute is
31 measured at the Waihe`e Hopoi gauging station. As the Hopoi Chute is approximately 100 yards

1 downstream of the gauging station (See FOF 272, *supra*), the amount reported as delivered to
2 Waiale Reservoir includes water flowing past the Hopoi Chute in the Waihe`e Ditch if there are
3 irrigation needs further down the ditch, such as filling Reservoirs 90, 92, 97, or 9 and used to
4 irrigate HC&S' leased 'Īao-Waikapū fields, Maui Tropical Plantation and the golf course. (Exh.
5 E-3; Hew, Tr. 1/29/08, p. 27, ll. 17-23, p. 28, ll. 9-13, p. 153, ll. 11-20; Chumbley, Tr. 1/24/08, p.
6 140, ll. 19-25.) HC&S FOF 89.

7 275. Waiale Reservoir receives water from the Spreckels Ditch as follows:

8 276. Spreckels Ditch diverts Waihe`e Stream via a stream diversion that is located below the
9 diversion that feeds the Waihe`e Ditch. At a point downstream of the diversion of Waihe`e
10 Stream into Spreckels Ditch, WWC drops an amount of water from the Waihe`e Ditch
11 determined by WWC to be necessary to service kuleanas in Waihe`e Valley into the Spreckels
12 Ditch from which it can be directed into the ditch servicing the kuleanas. (See FOF 269, *supra*.)

13 277. From approximately 1924 until Brewer stopped cultivating sugar in 1988, the Waihe`e
14 Stream water collected in the Spreckels Ditch, after satisfying kuleana users, was shared by
15 agreement between Brewer and HC&S, 1/2 to Brewer and 1/2 to HC&S down to South Waiehu
16 Stream. From at least the mid-1980's, this was administered by Brewer closing its intakes off of
17 the ditch that fed its reservoirs and fields below the Spreckels Ditch from 7:00 p.m. to 7:00 a.m.
18 daily. However, after 1988, the water previously taken by WWC and not delivered to kuleana or
19 other users has flowed down into the Waiale Reservoir for use by HC&S. (Hew, WDT 1/29/08, ¶
20 11B.) HC&S FOF 88B.

21 278. HC&S, at the Spreckels Ditch, diverts South Waiehu Stream via a stream diversion and
22 short ditch that transports the diverted water into the Spreckels Ditch. (Hew, WDT 1/29/08, ¶
23 11C; Hew, Tr. 1/28/08, p. 32, l. 8 to p. 33, l. 9.) HC&S FOF 88C.

24 279. Downstream in the Spreckels Ditch from the South Waiehu intake, approximately 0.1
25 mgd of ground water from a water development tunnel (HC&S's 'Īao Tunnel) is also deposited
26 into the Spreckels Ditch via an underground network of pipes and tunnels. (Hew, WDT 1/29/08,
27 ¶ 11D.) HC&S FOF 88D.

28 280. Further downstream in the Spreckels Ditch, HC&S diverts 'Īao Stream water into the
29 Spreckels Ditch. (Hew, WDT 1/29/08, ¶ 11E.) HC&S FOF 88E.

30 281. HC&S measures the aggregate water flow in the Spreckels Ditch at its Wailuku gauging
31 station, located downstream of the South Waiehu diversion, the intake pipe from the HC&S 'Īao

1 Tunnel, and the 'Īao Stream intake, none of which is separately gauged (but for which HC&S has
2 provided estimates –See FOF 187-190, *supra*). The gauged amount, therefore, includes water
3 diverted by WWC from Waihe'e Stream (and separately reported by WWC to CWRM) as well
4 as water diverted by HC&S from South Waiehu Stream, the HC&S 'Iao Tunnel and 'Iao Stream.
5 (Hew, WDT 1/29/08, ¶ 11F.) HC&S FOF 88F.

6 282. From March 2006, HC&S began receiving monthly reports from WWC indicating the
7 amount of water sent past the Hopoi chute. (Hew, Tr. 1/29/08, p. 27, ll. 14 to p. 28, l 2.) HC&S
8 FOF 89.

9 283. For HC&S's Waihe'e-Hopoi Fields, the average amount of water delivered to the Waiale
10 Reservoir between 1993 and July 2007, as calculated by combining the flows measured at the
11 Wailuku gauging station at the Spreckels Ditch and the Hopoi gauging station at the Waihe'e
12 Ditch, was approximately 39 mgd. (Hew, WDT 1/29/08, ¶ 12.) HC&S FOF 93.

13 284. The average water delivery from the Spreckels Ditch to Waiale Reservoir during this
14 period was approximately 18.39 mgd, with the remainder of approximately 20.61 mgd delivered
15 from Waihe'e Ditch through the Hopoi Chute. (Exh. E-4; Hew, Tr. 1/29/08, p. 37, ll. 16-23.)
16 HC&S FOF 90.

17 285. To illustrate the year-to-year variability, water delivered to the Waiale Reservoir for 2005
18 and 2006 were: 1) for 2005, 40.11 mgd—23.43 mgd from the Spreckels Ditch and 16.68 mgd
19 from the Waihe'e Ditch; and 2) for 2006, 31.04 mgd—16.72 mgd from the Spreckels Ditch and
20 14.32 mgd from the Waihe'e Ditch. (Exh. E-3, Exh. E-4, Exh. A-138.) WWC FOF 261.

21 286. For HC&S's 'Iao-Waikapū Fields ("Leased Fields"), WWC reported providing 9.98 mgd
22 during 2005 and 10.88 mgd during 2006. (Exh. E-3; Exh. E-4.)

23 287. WWC states that the water delivered to HC&S's 'Īao-Waikapū Fields is metered or
24 otherwise measured. (Hew, WDT 1/29/08, p. 7.) WWC FOF 259.

25 288. However, HC&S states that the reports of water deliveries to HC&S submitted by WWC
26 to the Commission are not based on meter readings. Instead, WWC calculates the number of
27 gallons delivered to users other than HC&S, and then attributes the balance to HC&S. As a
28 result, water that was not actually delivered to HC&S could be counted as delivered to HC&S.
29 (Chumbley, Tr., 1/24/08, p. 136, l. 14 to p. 138, l. 23; Exh. A-140, p. 47.) HC&S FOF 91.

30 289. The 'Īao-Waikapū Fields are irrigated with water from WWC's Reservoir 6, which can
31 receive water from 'Īao-Waikapū Ditch via the Waihe'e Ditch, the Waihe'e Ditch below the

1 Hopoi chute, and the South Waikapū Ditch. Water to irrigate the ‘Īao-Waikapū Fields comes
2 principally from ‘Īao Stream via the ‘Īao-Waikapū Ditch and Waikapū Stream via the South
3 Waikapū Ditch and Waihe‘e Ditch, all of which are operated by WWC. If necessary, water in the
4 Waihe‘e Ditch can be kept in the ditch past the Hopoi chute to supplement the flow from the
5 ‘Īao-Waikapū Ditch. Field 735, however, because of its elevation, can only be irrigated with
6 water from the South Waikapū Ditch. (See FOF 266, *supra*.)

7 8 **5. Summary of Uses**

9 290. Table 7 summarizes water deliveries for 2005 and 2006: totaling 60.65 mgd in 2005 and
10 53.97 mgd in 2006. These totals include: 1) waters diverted by HC&S from South Waiehu and
11 ‘Īao Streams into the Spreckels Ditch, because HC&S measures the aggregate water flow in the
12 Spreckels Ditch at its Wailuku gauging station, located downstream of the South Waiehu
13 diversion, the intake pipe from the HC&S ‘Īao Tunnel (which contributes an estimated 0.1 mgd),
14 and the ‘Īao Stream intake, none of which is separately gauged; and 2) waters from MDWS’s
15 ‘Īao Tunnel (1.59 mgd in 2005 and 1.76 mgd in 2006) and waters not diverted by MDWS to its
16 Water Treatment Facility, which enter the ‘Īao Ditch at its division into the ‘Īao-Maniania and
17 ‘Īao-Waikapū Ditches, which WWC estimates at 0.25-0.35 mgd (See FOF 153, *supra*). If we
18 subtract these ground water sources from total use, total use of waters diverted from the four
19 streams would be 58.66 mgd in 2005 and 51.81 mgd in 2006. Adding WWC’s estimate of
20 system losses at 7.34 percent, results in 62.97 mgd in 2005 and 55.61 mgd in 2006.

21 291. Table 8 summarizes the amounts of water diverted from the four streams in the same
22 periods. Estimates were that 56.50 mgd were diverted by WWC in 2005 and 48.94 mgd in 2006,
23 compared to 62.97 mgd in 2005 and 55.61 mgd in 2006 of deliveries, including losses. There is
24 some double-counting of deliveries, because the Hopoi Chute is approximately 100 yards
25 downstream of the gauging station, and the amount reported as delivered to Waiale Reservoir
26 includes water flowing past the Hopoi Chute in the Waihe‘e Ditch if there are irrigation needs
27 further down the ditch, such as filling Reservoirs 90, 92, 97, or 9 and used to irrigate HC&S’
28 leased ‘Īao-Waikapū fields. FOF 272, 274, *supra*. Most of the difference, however, is from
29 HC&S’s diversions on South Waiehu and ‘Īao Streams, which are included in Table 7’s
30 deliveries to Waiale Reservoir. As described in the previous FOF, HC&S measures the aggregate
31 water flow in the Spreckels Ditch at its Wailuku gauging station, located downstream of the

1 South Waiehu diversion, the intake pipe from the HC&S `Īao Tunnel, and the `Īao Stream intake,
2 none of which is separately gauged. The gauged amount, therefore, includes water diverted by
3 WWC from Waihe`e Stream and separately reported by WWC to CWRM, as well as water
4 diverted by HC&S from South Waiehu Stream, the HC&S `Īao Tunnel and `Īao Stream. FOF
5 281, *supra*.

6 292. Based on the numbers in Table 8 and including both WWC's and HC&S's diversions,
7 each of the four streams contributed the following percentages of diverted water: 1) Waihe`e
8 River: 58 percent in 2005 and 53 percent in 2006; 2) Waiehu Stream: seven percent in 2005 and
9 eight percent in 2006; 3) `Īao Stream: 28 percent in 2005 and 31 percent in 2006; and 4)
10 Waikapū Stream: seven percent in 2005 and eight percent in 2006.

11

12 **H. Future Uses**

13 **1. Kuleana Lands and Wetlands Restoration**

14 293. About 6.84 mgd is currently delivered to kuleana lands. (Table 7.)

15 294. Nearly 50 persons testified at the CCH, including many identified in Tables 3-6 and
16 others who wished to receive Na Wai `Ehā waters. Approximately 135 acres were involved, of
17 which about 45 acres were or were intended to be cultivated, primarily in wetland kalo but also
18 for vegetables, trees, and plants for subsistence and cultural purposes. (See Hui/MTF FOF D-1 to
19 D-458).

20 295. In contrast, HC&S identified 39 individuals or organizations that testified at the CCH,
21 seeking water for approximately 59.3 acres, of which approximately 51.8 acres would consist of
22 lo`i kalo. (See HC&S FOF 162B,172F, 174I, and 176G.)

23 296. Persons who were receiving water testified that the amounts currently delivered were
24 insufficient, and nearly all also wished to increase their land under cultivation. Most of those not
25 receiving water intended to resume or start cultivation of a portion of their lands. (See Hui/MTF
26 FOF D-1 to D-458.)

27 297. Reppun, Hui/MTF's expert witness, stated that "(w)etland kalo requires cool water
28 flowing over its roots to ensure the health and productivity of the crop. Irrigation, therefore,
29 needs to provide more water than just what is consumed in the lo`i through evaporation from
30 open water, transpiration through the kalo leaves, and percolation through the lo`i bottom and
31 sides." (Exh. A-12, p. 2.) Hui/MTF FOF D-463.

1 298. Reppun concluded that an average wetland taro complex requires between 100,000 to
2 300,000 gallons per acre per day (gad) of water to maintain water temperatures at or below 77°F
3 (27°C) and therefore prevent crop failure due to rot and pests. (Reppun, WDT 9/14/07, ¶¶ 4-5;
4 Reppun, Tr. 12/3/07, p. 114, ll. 21-25; Exh. A-176, pp. 16-17. Hui/MTF FOF D-468.

5 299. According to Reppun, kalo farmers don't consume water in the same way that offstream
6 water users do. Instead kalo farmers borrow water from the river then return that water so it can
7 serve other functions. (Reppun, Tr. 12/3/07, p. 135, ll. 5-10.) Hui/MTF FOF D-465.

8 300. Reppun also claims that the Watson study's conclusion that 15,000 to 40,000 gad was a
9 sufficient gross application amount to allow for sufficient outflow to assure good circulation
10 actually represented the amount of water consumed by the lo'i kalo and not the amount
11 necessary for throughflow. (Reppun, Tr. 12/3/07, p. 145, l. 19 to p. 146, l. 23; p. 147, l. 13 top.
12 148, l. 7.) **See also** Exh. A-176, p. 30 (interpreting Watson's 15,000 to 40,000 gad as the
13 consumption amount.) Hui/MTF FOF D-474.

14 301. In addition to the mostly small parcels of land that comprised the approximately 135
15 acres, North Shore at Waiehu, with 64 acres of land along the shore near Waiehu and `Īao
16 Streams, requested stream flow restoration so that springs would revive and help restore the
17 wetlands that previously comprised about one-third of the property. (**See** FOF 237, *supra*.) No
18 estimates were provided for the amounts required, and such restoration would not require a
19 noninstream water use permit, as revival of the springs might result from enhanced stream flow
20 at the mouths of Waiehu and `Īao Streams.

21 302. Maui Coastal Land Trust ("MCLT") owns the 277-acre Waihe'e Coastal Dunes and
22 Wetlands Refuge along the coast and along the mouth and southern edge of Waihe'e River, at
23 the base of Waihe'e Valley and extending across about 75 percent of the coastal portion of the
24 ahupua'a of Waihe'e. (Fisher, WDT 9/14/07, ¶ 3.) Hui/MTF FOF C-123.

25 303. MCLT seeks to restore stream flows to Waihe'e River to support: 1) 27 acres of what it
26 described as palustrine (marsh) wetlands habitat (known as the Kapoho or Waihe'e Wetlands)
27 and associated cultural resources including the loko kalo i`a (Hawaiian dual fishpond and taro
28 field) located in the wetlands; and 2) ten acres of riparian and estuarine wetlands habitat along
29 Waihe'e River, and associated cultural resources including over 20 ancient lo'i totaling about 1.7
30 acres. (Fisher, WDT 9/14/07, ¶¶ 4-8, 19, 22-23.) Hui/MTF FOF C-124, C-125.

1 304. Schwarm, MCLT's expert witness, recommended providing a flow of 1.5 mgd to 2.5
2 mgd from Waihe'e River, estimated at less than 25 percent of the likely historical 'auwai flow.
3 (Fisher, WDT 9/14/07, ¶ 20; Exh. A-43, pp. 1, 4-5.) This amount includes 0.75 mgd to 1.00 mgd
4 to raise the water levels by 18 inches to create standing habitat and 0.75 mgd to 1.50 mgd to
5 restore the ancient fishpond. (Exh. A-43, p. 1.) Hui/MTF FOF C-140.

6
7 **2. MDWS**

8 305. WWC's understanding is that MDWS was planning to increase the current capacity of
9 the 'Īao Water Treatment Facility from 3.2 mgd to 4.0 mgd, which will require an additional 0.8
10 mgd delivery from the 'Īao Stream, but there is nothing in the written agreements entered into
11 between WWC and MDWS that supports this statement. (Chumbley WDT, p. 9; Exh. D-93.)
12 WWC FOF 273-274.

13 306. MDWS, in conjunction with A&B, parent company of HC&S, have discussed possible
14 construction of a surface water treatment plant requiring anywhere from 2 mgd up to 9 mgd from
15 Waihe'e and 'Īao Streams. (Eng, Dec. 9/14/07, pp. 8-9; Eng, Tr. 12/13/07, pp. 123-125, 154-161,
16 and 206-211; Eng, Tr. 12/14/07, pp. 6-7, 9-11; Volner, Tr. 1/30/08, pp. 175-178; Exh. B-1, p. 5;
17 Holaday, Tr. 1/31/08, p. 76, l. 15 to p. 77, l.9.) WWC FOF 275. Details of the plant operations,
18 including delivery charges for A&B and allocation of water source credits, have not been agreed
19 upon. (Kuriyama, Tr. 2/22/08, pp. 18-21.) WWC FOF 277.

20
21 **3. WWC Delivery Agreements**

22 307. The maximum delivery agreements that WWC has with 34 entities total 8.288 mgd, and
23 the total amounts of water used under these agreements were 1.42 mgd in 2005 and 2.37 mgd in
24 2006. (**See** FOF 257-258, *supra*.)

25 308. Three end users that have delivery agreements with WWC indicated a desire for
26 additional water in the future to be used for agricultural, domestic and industrial purposes (Irani,
27 Dec. 9/17/07, pp. 3-4; Franco, Tr1/14/08, pp. 174-176, 206, and 208; Betsill, Tr. 1/25/08, pp.
28 120-121) WWC FOF 280, but the amount of additional water desired by the existing delivery
29 agreement end users is unknown. (Exh. D-96.) WWC FOF 281.

30 309. Three persons who are not presently end users indicated a desire to enter into water
31 delivery agreements and receive waters from Nā Wai 'Ehā streams. (Schwarm, Tr. 1/24/08, pp.

1 180 and 183-185; Hamamoto, Tr. 1/25/08, p. 32; Hamamoto, WDT 10/29/07, p. 3; Atherton,
2 WDT 9/17/07, p. 3) WWC FOF 282, and the total amount of water requested was approximately
3 4 mgd. (Schwarm, Tr. 1/24/08, pp. 180 and 183-185); Hamamoto, Tr. 1/25/08, p. 32; Hamamoto,
4 WDT 10/29/07, p. 3; Atherton, WDT 9/17/07, p. 3.) WWC FOF 283.

5
6 **4. HC&S**

7 310. HC&S plans to add, or has added, a portion of Field 767 to its lease with the Atherton
8 Hui of the `Īao-Waikapū Fields. (Volner, Tr. 1/30/08, p. 207, ll. 5-18; p. 213, ll. 8-16.) Of the
9 129 or 130 acres in Field 767, just over 40 acres will be added to the existing lease; 89 acres
10 “will not be guaranteed any specific land lease term as development plans in this area are in
11 progress.” (Exh. A-212, p. 3; Chumbley, Tr. 3/3/08, p. 97, ll. 18-22; p. 100, ll. 2 to p. 101, l. 14.)
12 Hui/MTF FOF F-122, F-123.

13 311. HC&S felt it would be prudent to cultivate Field 767 because it is not cultivating Field
14 920. (Volner, Tr. 1/30/08, p. 213, l. 23 to p. 214, l. 3; Holady, Tr. 1/31/08, p. 108, l. 23 to p. 109,
15 l. 4.) Hui/MTF FOF F-124.

16 312. HC&S expects that water will be available from WWC on the same flat rate per acre per
17 year terms as with the other leased fields, for use on Field 767, and WWC confirmed that that is
18 the verbal understanding between WWC and HC&S. (Exh. A-212, p. 3; Chumbley, Tr. 3/3/08, p.
19 102, ll. 2-6.) Hui/MTF FOF F-125.

20 313. Sometime between 1995 and 1997, HC&S entered into an agreement with Maui Land
21 and Pine (“MLP”) under which HC&S’s Fields 921 and 922, 300 acres which were “pasture
22 land” with “[q]uite a bit of kiawe trees,” would be cleared and planted in seed cane and watered
23 by wastewater from MLP’s cannery in Kahului. (Volner, Tr. 1/30/08, p. 161, l. 23 to p. 162, l.
24 16; Volner, Tr. 1/30/08, p. 27, ll. 21 to p. 28, l. 4.) Hui/MTF FOF F-126.

25 314. Fields 921 and 922, like neighboring Field 920, are sandy “scrub land”; Ms. Nakahata
26 explained that “for years HC&S had not farmed those fields because we thought it was sandy.”
27 (Santiago, Tr. 2/22/08, p. 130, ll. 7-19; Nakahata, Tr. 2/20/08, p. 25, ll. 18-23.) Mr. Volner was
28 not aware of any plans to cultivate that area prior to the agreement with MLP. (Volner, Tr.
29 1/30/08, p. 137, l. 16 to p. 138, l. 1.) Hui/MTF FOF F-127.

30 315. MLP built a pipeline to deliver wastewater several miles from its Kahului cannery to the
31 vicinity of Fields 921 and 922. (Volner, Tr. 1/30/08, p. 29, l. 16 to p. 30, l. 21; Exh. C-77.)

1 Deliveries of MLP wastewater averaged between 1.5 to 2.4 mgd in the years 2000 through 2005,
2 and dropped to an average of 0.78 mgd in 2006. (Exh. A-200; Exh. C-82, p. 3.) Hui/MTF FOF F-
3 128, F-129.

4 316. The volume of wastewater delivered by MLP was sufficient from 2004 through 2007
5 (Volner, Tr. 1/30/08, p. 139, ll. 18-23), but HC&S is “under the assumption” that the volume will
6 decrease although it has not “seen the numbers to validate that yet” and could not say whether
7 there would be a decrease in volume or how much that decrease would be.³ (Volner, Tr. 1/30/08,
8 p. 138, ll. 14-25). Hui/MTF FOF F-130.

9 317. HC&S anticipates that if the volume of wastewater from MLP decreases to where it is no
10 longer sufficient, it would look to use Nā Wai `Ehā water on Fields 921 and 922. (Volner, Tr.
11 1/29/08, p. 138, l. 24 to p. 139, l. 2.) Hui/MTF FOF F-131.

12

13 **I. Reasonable Uses, Losses, and Alternative Sources**

14

15 **1. Kuleana Lands and Wetlands Restoration**

16

17 **a. Kuleana Lands**

18 318. Several people residing on kuleana lands testified that they used “kuleana” ditch/pipe or
19 stream waters for domestic uses (e.g., Brito, WDT 10/26/07, ¶¶ 7-8; Hui/MTF FOF D-241;
20 Kamaunu, WDT 10/26/07, ¶¶ 2, 5-7; Kamaunu, Tr. 12/13/07, p. 45, ll. 4-17; Hui/MTF FOF D-
21 102).

22 319. MDWS’s “average typical residential customer” uses 400 to 600 gallons per day (“gpd”)
23 of combined indoor and outdoor use and 1,500 to 2,000 gpd for customers irrigating “lush
24 tropical landscape treatment” in the island’s most arid areas (e.g., Maui Meadows or Kihei). (Eng,
25 Tr. 12/13/07, p. 191, l. 7 to p. 192, l. 5; Eng, Tr. 12/14/07, p. 4, ll. 9-22.) Hui/MTF FOF E-75.

26 320. As described earlier, Reppun, Hui/MTF’s expert witness, concluded that an average
27 wetland taro complex requires between 100,000 to 300,000 gad to maintain water temperatures
28 at or below 77°F (27°C) and therefore prevent crop failure due to rot and pests. (**See** FOF 298,
29 *supra.*)

³ See footnote to FOF 261, describing the cessation of MLP’s pineapple operations.

1 321. Reppun also claimed that the Watson study's conclusion that 15,000 to 40,000 gad was a
2 sufficient gross application amount to allow for sufficient outflow to assure good circulation
3 actually represented the amount of water consumed by the lo'i kalo and not the amount
4 necessary for throughflow. (See FOF 300, *supra*.)

5 322. Reppun further claimed that a study by de La Pena measured only the total amount of
6 water flowing into the lo'i and that therefore de La Pena's 30,000 gad kalo water duty likely also
7 represented net consumption. (Reppun, Tr. 12/3/07, p. 143, ll. 19-20.) Hui/MTF FOF D-475.

8 323. Finally, Reppun also cited a USGS report on Water Use in Wetland Kalo Cultivation in
9 Hawai'i, which provided "baseline information on wetland kalo irrigation practices for a variety
10 of geographical settings in the Hawaiian Islands." (Exh. A-12, pp. 2-3.) Hui/MTF FOF D-476.

11 324. USGS reported that "(t)he water need for kalo varies depending on the crop stage. To
12 ensure that flow and temperature data collected at different lo'i reflected similar irrigation
13 conditions (continuous flooding of a mature crop), only lo'i with crops near the harvesting stage
14 were selected for data collection. Data were collected during the dry season (June-October),
15 when water requirements for cooling kalo approach upper limits. Flow measurements generally
16 were made during the warmest part of the day and temperature measurements were made every
17 15 minutes at each site for about a two-month period." (Oki, WDT 9/14/07, ¶¶ 70-71.)

18 325. "The average (mean) inflow for all lo'i complexes was 260,000 gad and the median
19 inflow was 150,000 gad. At the individual lo'i level, inflow averaged 350,000 for all sites. In
20 Waihe'e, lo'i complex inflows ranged from 110,000 to 160,000 gad. The measured inflows for
21 Waihe'e lo'i complexes were less than the average inflow for the Island of Maui (230,000 gad)
22 and the average inflow for all sites in the State (260,000 gad), although the median value for the
23 State (150,000 gad) was within the range of measured inflows for the Waihe'e lo'i complexes."
24 (Oki, WDT 9/14/07, ¶¶ 75-76.)

25 326. "Of the 17 lo'i complexes where water inflow temperature was measured, only 3 lo'i
26 complexes had inflow temperature values greater than 27°C for more than 0.05 percent of the
27 time. A water temperature of 27°C is considered the threshold temperature above which wetland
28 kalo is more susceptible to fungi and associated rotting diseases (Gingerich and others, 2007). In
29 the Waihe'e Maui upper lo'i complex, inflow temperature did not exceed 27°C during the study
30 period, and the mean inflow temperature was 21.6°C. In the Waihe'e Maui lower lo'i complex,
31 inflow temperature exceeded 27°C about 25 percent of the time which is more frequent than for

1 any other lo`i complex studied. In addition, the lower Waihe`e lo`i complex recorded the
2 warmest mean inflow temperature (24.9°C) and the most variable inflow temperature value
3 (7.6°C mean daily range) of all the lo`i complexes where temperature was measured in this
4 study.” (Oki, WDT 9/14/07, ¶ 77.)

5 327. “During field visits, the USGS also interviewed farmers about their irrigation practices
6 and about their perceptions of their water supply. In general, most farmers believed that their
7 supply of irrigation water was insufficient for proper kalo cultivation. (Gingerich and others,
8 2007.)” (Oki, WDT 9/14/07, ¶ 78.)

9 328. From these findings and Reppun’s observation that the outflow water temperature often
10 exceeded the threshold for root fungus (27°C), he concluded that 300,000 gad must be
11 consistently available to satisfy current demand for water to grow healthy kalo. (Reppun, WDT
12 9/14/07, ¶ 13; Reppun, Tr. 12/3/07, p. 131, ll. 1-6.) Hui/MTF FOF D-484.

13 329. However, the USGS study was intentionally designed for continuous flooding of a
14 mature crop during the dry season (June-October), when water requirements for cooling kalo
15 approach upper limits, and covered only a two-month period at the end of the kalo crop cycle,
16 when plants were near the harvesting stage. (See FOF 324, *supra*.) Yet, Reppun extrapolated
17 these maximum requirements for water inflow into kalo lo`i to conclude that 300,000 gad was
18 the daily requirement for the entire growing cycle.

19 330. In de La Pena’s study, the crop cycle was 14 months. (Exh. A-174, p. 99.) Watson and
20 Grance assumed that “as a general average throughout Hawaii no water is required to enter
21 patches approximately 40 to 50 per cent of the time, either because of cultural practices including
22 planned resting or fallowing of patches.” (Exh. A-171, App. A.)

23 331. The number of future “kuleana” users beyond those identified at the CCH is unknown.

24 332. Taking the approximately 45 acres mostly in or intending to be cultivated in wetland kalo
25 by those testifying at the CCH (See FOF 294, *supra*) and dividing the 6.84 mgd currently
26 delivered to “kuleana” lands (See Table 7), current average inflow would be 152,000 gad. These
27 45 acres include parcels not currently served (See FOF 294, *supra*), so the per acre water
28 delivery would be higher for those currently receiving water. This would be the average amount
29 of water delivered daily.

1 333. If HC&S's estimate of 51.8 acres (See FOF 295, *supra*) in or intending to be cultivated in
2 wetland kalo were used instead of 45 acres, the 6.84 mgd would average 132,000 gad. As in the
3 45-acre estimate, the per acre water delivery would be higher for those currently served.

4 334. During the dry season (June-October) when water requirements for cooling kalo
5 approach upper limits, the average inflow for all lo'i complexes in the USGS study was 260,000
6 gad, and the average inflow for the Waihe'e lo'i complexes ranged from 110,000 to 160,000 gad.
7 While the water temperature of these inflow rates were below the threshold temperature of 27⁰C
8 for susceptibility to rotting diseases in 95 percent of the lo'i complexes in the USGS study, in
9 general, most of the kalo farmers still believed their supply of irrigation water was insufficient
10 for proper kalo cultivation. (See FOF 327, *supra*).

11 335. WWC kuleana users who testified at the CCH also complained of inadequate water (See
12 FOF 296, *supra*), even at the current estimated daily inflow rate of more than 150,000 gad, an
13 average daily rate over the entire crop cycle that includes periods when water requirements for
14 cooling kalo approach upper limits of at least twice the average.

15 336. However, USGS's Nā Wai `Ehā study observed numerous return flows and leakages
16 from the ditches into all four streams (Oki, WDT 9/14/07, ¶¶ 38, 40-42), so substantial losses
17 through the ditches are likely occurring.

18 337. A substantial amount of water is needed for inflow above what is consumed by the lo'i
19 themselves for proper kalo cultivation. This large amount of inflow and outflow would result in
20 substantial losses, unless as much of the outflow as practical is channeled back into the streams.
21 (See FOF 320-322, *supra*).

22 338. Cox noted that in addition to the net loss in the irrigation of the lo'i (i.e., consumption),
23 "a considerably greater amount would have to be diverted in order to successfully grow taro with
24 proper circulation of water. This excess water in the upper areas would be returned to the stream
25 and be subject to redirection lower down... That used on the areas adjacent to the estuary and
26 below the lowest diversion ditch could not be redirected and would be an increase in necessary
27 water consumption." (Exh. A-172, Letter of Submittal, p. 2.)

28 339. Moreover, Reppun identified lo'i water consumption as consisting of evaporation from
29 open water, transpiration through the kalo leaves, and percolation through the lo'i bottom and
30 sides (See FOF 297, *supra*). Watson also observed numerous leakages in the sides of the lo'i in

1 his study. Exh. A-171, Memorandum of June 24, 1964. Thus, most of the water “consumption”
2 by kalo lo`i is most likely through leakage, and minimally through evaporation and transpiration.

3
4 **b. Maui Coastal Land Trust (“MCLT”)**

5 340. MCLT seeks water to restore 27 acres of what it describes as “prime palustrine” Kapoho
6 wetlands and associated cultural resources, including a seven-acre loko kalo i`a fishpond-taro
7 field system to create a more consistent standing wetland habitat for native plants and animals,
8 including endangered bird species. (Fisher, WDT 9/14/07, ¶¶ 4-8, 19 Fisher, Tr. 12/04/07, p. 57,
9 ll. 2-11.) MCLT seeks to restore freshwater to the Kapoho wetlands habitat and loko kalo i`a by
10 restoring application of stream flow from Waihe`e River. (Fisher, WDT 9/14/07, ¶ 6, 19.) HC&S
11 FOF 165. Hui/MTF FOF C-124, C-136, C-138.

12 341. Various kuleana parcels are located around the outer portion of the wetlands, and the
13 documentation at the time of the Māhele described “kalo,” “lo`i,” “pond,” and “fishponds,”
14 confirming that water flowed to the Kapoho Wetlands at the time of the Māhele. (Fisher, WDT
15 9/14/07, ¶¶ 9, 11; Exh. A-40, p. 23; Exh. A-42.) In acquiring the Refuge lands, MCLT received
16 three of these parcels totaling 2.17 acres via quitclaim deed with “all the rights, easements,
17 privileges and appurtenances thereto belonging or appertaining.” (Fisher, WDT 9/14/07, ¶ 11;
18 Exh. A-41, pp. 0012, 0014.) Hui/MTF FOF C-137.

19 342. MCLT also seeks more water flowing to the mouth of Waihe`e River to increase ground
20 water seepage into the wetland habitat to support ten acres of riparian and estuarine wetlands
21 habitat along Waihe`e River, and associated cultural resources including over 20 ancient lo`i
22 totaling about 1.7 acres. (Fisher, WDT 9/14/07, ¶¶ 6, 22-23; Fisher, Tr. 12/04/07, p. 55, ll. 15-16;
23 p. 62, l. 22 to p. 63, l. 6; p. 63, ll. 22-24.) Hui/MTF FOF C-125. HC&S FOF 165.

24 343. Schwarm, who was qualified as an expert civil engineer (Tr. 12/4/07, p. 132, ll. 14-17),
25 prepared a Preliminary Water Budget Evaluation for MCLT. (Fisher WDT 9/14/07, ¶ 20; Exh.
26 A-43; Schwarm, Tr. 12/4/07, p. 133, ll. 10-17.) Schwarm explained that civil engineering
27 includes hydrology as a “normal part of our work,” and that the work he conducted for MCLT is
28 normal civil engineering within the scope of his expertise. (Schwarm, Tr. 12/4/07, p. 132, ll. 10-
29 13; p. 133, ll. 4-9.) Hui/MTF FOF C-139.

1 344. Schwarm acknowledged that his experience in development of ground water resources is
2 very limited, and he does not consider himself an expert in the field of ground water resources.
3 (Schwarm, Tr. 12/4/07, p. 153, ll. 10-12.) HC&S FOF 165.

4 345. To accomplish MCLT's ecological and cultural restoration goals, Schwarm
5 recommended providing a flow of 1.5 mgd to 2.5 mgd from Waihe'e River, or less than 25
6 percent of the likely historical 'auwai flow. (Fisher, WDT 9/14/07, ¶ 20; Exh. A-43, pp. 1, 4-5.)
7 This amount includes 0.75 mgd to 1.00 mgd to raise the water table elevations between 12 and
8 18 inches, which Schwarm believes is sufficient to provide the consistent water necessary for
9 restoring habitat within the Kapoho wetland (Exhibit A-43 at 1), and running 0.75 mgd to 1.50
10 mgd of fresh water through the fishpond, which should be sufficient to restore favorable
11 aquaculture conditions within the ancient fishpond limits. (Exh. A-43, p. 1.) Hui/MTF FOF C-
12 140. HC&S FOF 165.

13 346. Schwarm conducted these calculations as a best estimate, based on available data on
14 topography, soil types, and reported current water levels, and subject to revision once flow is
15 restored. (Schwarm, WDT 11/16/07, ¶¶ 9, 2; Tr. 12/4/07, p. 176, ll. 15-18; p. 132, ll. 2-9; p. 134,
16 l. 11 to p. 136, l. 5; 134, ll. 11-18.) No one, including Nance, HC&S's consultant, provided any
17 contrary calculations. Hui/MTF FOF C-141.

18 347. Schwarm also opined that restoration of flows of Waihe'e River, in themselves, would
19 help to replenish the underlying aquifer and raise water levels in the wetlands. (Exh. A-43, pp. 5-
20 6; Schwarm, Tr. 12/4/07, p. 168, ll. 6-11.) **See also** Exh. A-223, p. 6 (stating that the wetlands
21 are "sustained mostly by the Waihee Stream"). Hui/MTF FOF C-142.

22 348. Schwarm's recommendation that the water table be elevated up to 18 inches was based
23 solely on his professional judgment that the target habitat restoration goals were analogous to a
24 rise in water levels of 18 inches. That conclusion was in turn premised on the working
25 assumption, based on reports from others, that water levels were typically 18 inches below grade
26 in the area where MCLT intended to restore wetland habitat during non-drought conditions.
27 (Schwarm, Tr. 12/4/07, p. 147, l. 10 to p. 148, l. 19, p. 157, ll. 6-9.) However, there is no reliable
28 way of measuring whether the target water levels are reached, given variations in (a) the
29 elevation levels across the wetlands and (b) the stratified permeability of the substrate of the
30 wetlands, which is not known. (Schwarm, Tr. 12/04/07, p. 158, l. 13 to p. 159, l. 9; Nance, Dec.
31 10/26/07, ¶ 11.) HC&S FOF 166.

1 349. Schwarm's water budget also assumed that ground water levels remain constant over
2 time. He acknowledged that ground water levels vary with rainfall and tide, but his calculations
3 assumed that tide levels remain constant. (Schwarm, Tr. 12/4/07, p. 159, l. 10 to p. 160, l. 11.)
4 HC&S FOF 166.

5 350. The flow levels recommended in Schwarm's water budget were not based on scientific
6 knowledge of the water requirements of the bird species within the Kapoho wetlands. (Schwarm,
7 Tr. 12/4/07, p. 157, ll. 6-9.) No evidence of the specific water requirements for the species was
8 presented. Although one of the recovery actions listed in the Draft Revised Recovery Plan for
9 Hawaiian Waterbirds prepared by the U.S. Fish & Wildlife Service is "secure water sources and
10 manage water levels to maximize nesting success, brood survival, food availability, and
11 recruitment of waterbirds," the recovery plan does not specify the amount of water that should be
12 secured at the Kapoho wetlands. (Duvall, Tr. 12/4/07, p. 12, ll. 7-24; Exh. A-38C, pp. 80, 136.)
13 Duvall, a wildlife biologist with the Department of Land and Natural Resources, Division of
14 Forestry and Wildlife in Maui District, was unable to identify the quantity of water needed to
15 support recovery of endangered waterbirds in the Kapoho wetlands. (Duvall, Tr. 12/4/07, p. 107,
16 ll. 17-22, p. 114, l. 25 to p. 115, l. 4.) Duvall recommended restoration of the water level in the
17 wetlands to the extent he observed in 1990, but he could not quantify what that amount was.
18 (Duvall, Tr. 12/4/07, p. 115, ll. 19-24, p. 116, ll. 11-13.) He further acknowledged that the water
19 requirement differs for each species. (Duvall, Tr. 12/4/07, p. 115, ll. 15-18.) HC&S FOF 167.

20 351. Nance, a civil engineer and hydrologist testifying on behalf of HC&S, disputed MCLT's
21 characterization of the Kapoho wetlands as "palustrine," which he characterizes as a nontidal
22 wetland where the salinity level due to ocean-derived salts is below 0.5 parts per thousand
23 ("ppt"). Palustrine wetlands are typically inland. (Nance, Tr. 12/11/07, p. 151, ll. 11-16, p. 170, ll.
24 10-13.) Nance's opinion was that the Kapoho wetlands are not palustrine, because they are
25 situated in a near-shore environment, are tidally influenced, and their salinity level has been
26 measured at between 1.68 ppt to 2.25 ppt, well above the threshold for classification as a
27 palustrine wetland. (Nance, Tr. 12/11/07, p. 152, l. 10 to 153, l. 5; Exh. A-162.) HC&S FOF 168.

28 352. Nance also described the basal ground water body underlying the wetlands as located in
29 the volcanic formation at depth, not in the sedimentary sand and alluvium in which the wetland
30 is located. This generally less permeable sedimentary caprock overlies the volcanics. At least in
31 part, ground water in this overlying formation may have originated as upward leakage from the

1 basal aquifer in the volcanics at depth, but it is otherwise hydrologically a distinct ground water
2 body that is generally more saline and limited in aerial extent. Under completely natural
3 conditions, the wetland would be an exposure of the brackish to saline ground water in the
4 sedimentary formation. Thus, the Kapoho wetlands cannot be characterized as “palustrine.”
5 (Nance, Dec. 10/27/07, ¶ 8.) HC&S FOF 168.

6 353. Nance opined that to the extent that artificially raising the water level in the wetland to
7 create bird habitat is MCLT’s objective, a reasonable alternative to a diversion from the Waihe’e
8 River would be to drill a well into the underlying basal aquifer in the volcanics. If the basal head
9 is not adequate for gravity delivery, only low head pumping at quite modest expense would be
10 required. As an example, Well 5327-10 with low head pumping of basal ground water has been
11 the source of supply for the Kanaha Pond for decades. (Nance, Dec. 10/27/07, p. ¶ 12.) HC&S
12 FOF 170.

13 354. Duvall, who has managed Kanahā Pond since 1996 (Duvall, Tr. 12/04/07, p. 102, ll. 12-
14 13), maintained that pumping merely attempts to maintain water levels for the short term, but in
15 and of itself has not allowed Kanahā Pond over the long term to maintain water in areas that used
16 to be wet. (*Id.* p. 124, ll. 10-20; p. 111, ll. 15-24.)

17 355. Schwarm and Duvall were of the opinion that attempting to maintain water levels by
18 circulating ground water to the surface where it evaporates simply places further demands on an
19 already diminished ground water source. (Schwarm WDT 11/16/07, ¶ 10; Duvall, Tr. 12/04/07,
20 p. 110, ll. 15-24.) Duvall and Schwarm also stated that pumping ground water to raise wetlands
21 water levels is analogous to the operation of a table-top fountain, and equivalent to “chas[ing]
22 your tail.” (Duvall, Tr. 12/04/07, p. 123, ll. 18-21; p. 110, ll. 18-20; Scharm, Tr. 12/04/07, p.
23 177, ll. 12.) They were of the opinion that it is “terribly inefficient,” “not sustainable,” and “does
24 not provide a good long-term solution.” (Scharm, Tr. 12/04/07, p. 177, ll. 1-13; Fisher, Tr.
25 12/04/07, p. 69, ll. 5-11; Duvall, Tr. 12/04/07, p. 112, ll. 10-13.) Hui/MTF FOF C-147.

26 356. Both Schwarm (a civil engineer without expertise in the field of ground water resources)
27 and especially Duvall (a biologist), were not qualified to testify as expert witnesses on ground
28 water resources, and had no expertise to conclude that pumping basal ground water to raise
29 wetlands water levels was analogous to a table-top fountain, in which they presumably assumed
30 that the wetlands water would then leak back through the caprock into the underlying volcanic
31 basal aquifer. Nance, an expert in hydrology and ground water, had stated that ground water in

1 the overlying formation may have originated as upward leakage from the basal aquifer in the
2 volcanics at depth, but it is otherwise hydrologically a distinct ground water body that is
3 generally more saline and limited in aerial extent. (See FOF 344, 350, *supra*).

4 357. Schwarm also concluded that ground water pumping poses a real risk of drawing salt
5 water into the wetlands and causing irreparable harm. (Schwarm, Tr. 12/04/07, p. 177, l. 14 to p.
6 178, l. 4.), because the ground water near the coastline forms a convex lens that thins out closer
7 to the shore, increasing the risk of a well drawing seawater. (*Id.* p. 182, ll. 7-15.) Hui/MTF FOF
8 148. However, in addition to Schwarm not being an expert in ground water resources, he did not
9 explain why a well that might draw seawater would not quickly be capped if that event were to
10 occur.

11 358. MCLT also seeks more water flowing to the mouth of Waihe'e River to increase ground
12 water seepage into the Kapoho wetlands. (Fisher, WDT 9/14/07, ¶ 21.) The Kapoho Wetlands
13 were historically sustained by both water percolating from underground, and stream water
14 flowing from Waihe'e River via the 'auwai. (Fisher, WDT 9/14/07, ¶¶ 7-8.) The ground water
15 source has diminished, however, because of factors such as the development of the former
16 wetlands on the opposite side of the dune, (*Id.* ¶ 13; Exh. A-43, p. 4.) Hui/MTF FOF C-144, an
17 event that happened long after the flow at the mouth of Waihe'e River diminished to its present
18 state.

19 359. Nance opined that there is no support for the assumption that seepage from Waihe'e
20 River has a direct connection to ground water in the sedimentary caprock and water levels in the
21 wetland. His view was that it is far more likely that there is a hydrologic disconnect between the
22 ground water body and the wetlands, and that there would be no increase in the water level in the
23 wetlands in response to increased seepage from Waihe'e River. Thus, elevating the water level of
24 the wetlands would have to be accomplished by a direct delivery of water, either conveyed from
25 Waihe'e River in a ditch or pipe or pumped in from a well. (Nance, Dec. 10/27/07, ¶ 10) The
26 presence of the ancient 'auwai tends to support this view. HC&S FOF 169.

27 28 **2. MDWS**

29 360. On February 15, 2006, CWRM approved the Water Use Permit Applications for existing
30 uses in the basal portion of the 'Īao aquifer submitted by MDWS, totaling 11.227 mgd. (Minutes
31 of the February 15, 2005 CWRM Meeting; see also Findings of Fact, Conclusions of Law, and

1 Decision and Order “In the Matter of Water Use Permit Applications for the `Īao Ground Water
2 Management Area Basal Source Contested Case Hearing” (CCH-MA05-1) issued January 31,
3 2007, p. 4, ¶ 2.) MDWS FOF 4.

4 361. In issuing Water Use Permits to MDWS for seven of its basal sources, CWRM was
5 required to determine, and did determine, that MDWS’s Water Use Permits met all statutory
6 criteria under Hawaii Revised Statutes (“H.R.S.”) § 174C-49. (Minutes of the February 15, 2005
7 CWRM Meeting; see also Findings of Fact, Conclusions of Law, and Decision and Order “In the
8 Matter of Water Use Permit Applications for the `Īao Ground Water Management Area Basal
9 Source Contested Case Hearing” (CCH-MA05-1) issued January 31, 2007, ¶¶ 33 – 50;
10 “MDWS’s water use permit [for Shaft 33] also meets all of the Code’s requirements.” (Id., ¶ 9.)
11 MDWS FOF 5.

12 362. CWRM’s findings with respect to MDWS’s basal sources and Shaft 33 (also known as
13 the “Wailuku Shaft”) also apply to MDWS’s Water Use Permits at issue in this proceeding,
14 because all of MDWS sources are part of its integrated Central Maui System. (Eng, Dec. 9/14/07,
15 ¶¶ 7, 9, 13, 15.) MDWS FOF 6.

16 363. The County of Maui relies on water from its two high level sources, Kepaniwai Well and
17 MDWS’s `Īao Tunnel, to supply a total of 2.401 mgd to the people and businesses served by the
18 County’s Central Maui System. (Eng, Dec. 9/14/07, ¶ 6.) MDWS FOF 8.

19 364. The two applications filed by MDWS are for the same purposes as the water use permits
20 granted to MDWS for Shaft 33 and seven other previously filed applications, and those were all
21 found to be consistent with applicable plans, land use classifications, and land use policies.
22 (Staff submittal for the CWRM meeting of Feb. 15, 2006, p. 7, and Findings of Fact,
23 Conclusions of Law, and Decision and Order “In the Matter of Water Use Permit Applications
24 for the `Īao Ground Water Management Area Basal Source Contested Case Hearing” (CCH-
25 MA05-1) issued January 31, 2007, ¶ 46.) MDWS FOF 39.

26 365. OHA does not object to MDWS’s Water Use Permit Applications for MDWS’s `Īao
27 Tunnel and Kepaniwai Well. (Apoliona, WDT 12/3/07, p. 16, ll. 7 – 24.) MDWS FOF 34.

28 366. The 2.401 mgd sought by MDWS in its Water Use Permit Applications will not interfere
29 with the rights of the Department of Hawaiian Home Lands (“DHHL”). MDWS’s Central Maui
30 system serves homes built by DHHL. (Eng, Dec. 9/14/07, ¶ 50.) MDWS FOF 40.

31 367. DHHL has not objected to MDWS’s Water Use Permit Applications and has not

1 requested party status in this contested case. (Eng, Dec. 9/14/07, ¶ 50.) MDWS FOF 41.

2 368. Through an agreement with WWC, MDWS receives up to 3.2 mgd of surface water from
3 the `Īao-Waikapū Ditch and plans to increase the capacity to 4.0 mgd. (**See** FOF 239 and 305,
4 *supra.*)

5 369. MDWS also has had discussions with A&B concerning the potential for a surface water
6 treatment plant to be located near the Waiale reservoir. (**See** FOF 306, *supra.*)

7 370. MDWS has considered drilling new wells in the Waihe`e and Kahakuloa aquifers, but
8 CWRM has asked MDWS to limit its withdrawals from the Waihe`e aquifer, and USGS has
9 indicated that new wells there may not be as productive or cost-effective as hoped. (Eng, Dec.
10 9/14/07, ¶ 27.) MDWS FOF 34.

11 371. USGS has indicated that the Waikapū aquifer may be a possible source of new water
12 supply, but the current sustainable yield of that aquifer is 2 mgd (Exh. B-13), and MDWS
13 expects competition from private landowners for the available water in this aquifer. (Eng, Dec.
14 9/14/07, ¶ 27.) MDWS FOF 46.

15 372. The ability of MDWS to utilize water sources from East Maui is restricted by a consent
16 decree in the case of Coalition to Protect East Maui Water Resources v. Board of Water Supply,
17 County of Maui, Civ. No. 03-1-0008(3), December 2003.

18 373. That consent decree requires that “(b)efore any new project is planned by the County of
19 Maui to develop ground water in the agreed-upon portion of the East Maui Region, the County
20 will vigorously investigate and pursue the availability of surface water from the Waikapū
21 (60101), `Īao (60102) and/or Waihe`e (60103) hydrologic units for public use by preparing a
22 report which shall include a rigorous analysis of the costs and benefits of making these water
23 resources part of Maui’s public water system.” (Exh. B-10, ¶ 4.3.) MDWS FOF 47.

24

25 **3. WWC Water Delivery Agreements**

26 374. WWC estimated the amount of losses from its ditch system as a set percentage of 7.34
27 percent, based primarily on a 20-year old report, Exh. D-4A. (Suzuki, Tr. 12/14/07, p. 164, l. 11
28 to p. 165, l. 23.) Hui/MTF FOF E.35.

29 375. The great majority of WWC’s ditches are open and unlined. (Suzuki, Tr. 12/14/07, p.
30 159, ll. 11-13; pp. 159-62.) All of WWC’s reservoirs are unlined. (*Id.* p. 162, l. 25 to p. 164, l.
31 10; Santiago, Tr. 2/22/08, p. 135, ll. 13-15.) Hui/MTF FOF E-36.

1 376. WWC did not address the feasibility of minimizing the losses from its system except to
2 state that it “may . . . in the future” have plans to line the unlined portions of their system.
3 (Suzuki, Tr. 12/14/07, p. 268, ll. 21-25.) Hui/MTF FOF E-39.

4 377. WWC has water-delivery agreements with 34 entities in addition to its agreement with
5 MDWS and HC&S. Its table of customers does not provide information on any acreages
6 cultivated and does not identify the nature of the water uses, except to label them generally as
7 either “agriculture” or “irrigation.” Under WWC’s terminology, “irrigation” is “agriculture,” but
8 on a shorter-term basis and also includes dust control. (See FOF 241, *supra*.)

9 378. Only a few of the 34 entities provided information of their current and/or future uses.

10 379. Maui Cattle Company (“MCC”) used water to irrigate its 240-acre pasture for cattle in
11 Ma`alaea, starting around March 2006 and eventually using at its peak 0.99 mgd to 1 mgd.
12 (Franco, Tr. 1/14/08, p. 174, ll. 22-24; p. 176, ll. 17-19.) Hui/MTF FOF E-40.

13 380. The irrigated area has shrunk from 240 acres to 25 acres (Franco, Tr. 1/14/08, p. 192, ll.
14 6-14), and the number of cattle has decreased from a high of 375 to only 60 animals (*id.* p. 176, l.
15 4; p. 186, ll. 8-11). Hui/MTF FOF E-48. 381.

16 381. According to WWC’s records, MCC’s water use has decreased to only 8.84 mg from
17 January to October 2007, or about 29,000 gpd (1,160 gad). (Exh. C-70 (TMK No. 3-6-01:018).)
18 MCC stated that this amount is “sufficient.” (Franco, Tr. 1/14/08, p. 186, ll. 19-22.) Hui/MTF
19 FOF E-49.

20 382. MCC has indicated no plans to continue even its reduced use. MCC’s landowner seeks to
21 develop the property. (Atherton, Dec. 9/14/07, ¶ 15.) See also Franco, Tr. 1/14/08, p. 184, ll. 2-
22 18 (both lease and water license mutually terminable with 30-days notice). MCC stated that “if”
23 it were to re-lease the property, it would simply “graze it on a seasonable basis and without
24 major irrigation.” (*Id.* p. 181, l. 23 to p. 182, l. 6.) Hui/MTF FOF E-50.

25 383. Michael Atherton, along with various partners, own several entities that have acquired
26 former Wailuku plantation lands, including Ma`alaea Properties, Waikapū Properties, and Maui
27 Tropical Plantation (collectively, “Atherton et al.”). Mr. Atherton’s partners provide equity and
28 are “mainly in the development business,” and Mr. Atherton is also in the real estate
29 development business. (Atherton, Tr. 2/21/08, p. 128, l. 24 to p. 129, l. 1.)Hui/MTF FOF E-110,
30 E-111.

1 384. Atherton et al. seek to develop the Ma`alaea pasture currently occupied by Maui Cattle
2 Company, TMK No. 3-6-01:18. (Atherton, Dec. 9/14/07, ¶ 15.) Hui/MTF FOF E-115.

3 385. Atherton et al. stated that the Ma`alaea development project and its potential alternatives
4 for water use are still “a long ways” away and “all proposed . . . not fact.” (Atherton, Tr.
5 2/21/08, p. 134, ll. 15-20; p. 143, ll. 11-17.) Among other approvals, the project still must seek
6 state and county rezoning out of agriculture. (*Id.* p. 212, l. 5 to p. 213, l. 2.) Hui/MTF FOF E-117.

7 386. An alternative water source of approximately 620,000 gpd of wastewater the
8 development project would generate could be reclaimed in an onsite facility. (Atherton, Tr.
9 2/21/08, p. 132, ll. 13-23.) Hui/MTF FOF E-118.

10 387. Aside from the possible alternative source of reclaimed water from its own contemplated
11 treatment plant, Atherton et al. have had no discussions with the County about reclaimed water
12 and hopes to reserve water from their five existing and planned wells for off-site transport to
13 their desired development. (Atherton, Tr. 2/21/08, p. 194, l. 24 to p. 195, l. 13.) Hui/MTF FOF
14 E-125, E-126.

15 388. Atherton et al. also proposed a coffee plantation on TMK Nos. 3-6-004:003 and 3-6-
16 004:006, claiming water usage of 10,000 gad on more than 200 acres. (Exh. D-94, p. 1.) Mr.
17 Atherton based the figure on 120 to 130 inches a year, but he has conducted no research on water
18 use for coffee in different locations, notwithstanding his acknowledgement that water use
19 “depends on the area” and “the factors at a specific location,” and “[e]very area is different.”
20 (Atherton, Tr. 2/21/08, p. 168, l. 23 to p. 169, l. 15; p. 171, ll. 1-4; p. 203, ll. 19-22; p. 169, ll. 18-
21 20.) Hui/MTF FOF E-120.

22 389. Atherton operates a coffee plantation in Kualapu`u, Moloka`i on about 300 acres.
23 (Atherton, Tr. 2/21/08, p. 114, l. 23 to p. 115, l. 5.) For two years, that plantation did not irrigate
24 at all, and in the last two years, it used an annual amount of 100 to 300 million gallons, or up to
25 2,739 gad. (*Id.* p. 168, ll. 3-9.) Now, the plantation “actually [is] in the black,” and “[t]he last
26 few years have been good.” (*Id.* p. 119, ll. 4-10; p. 122, ll. 5-13.) Hui/MTF FOF E-121.

27 390. For Maui Tropical Plantation, the usage stated in WWC’s water use reports and
28 subpoenaed invoices indicate that MTP’s water use over the period of 2001 through 2007 has
29 averaged 114,313 gpd (1,938 gad over the 59 acres). (Exh. A-140, p. 20; Exh. D-97; Atherton,
30 Tr. 2/21/08, p. 180, ll. 1-11.) Hui/MTF FOF E-124.

1 391. MMK Maui (“MMK”), owner of the Kahili Golf Course and King Kamehameha Golf
2 Club has stated that “(t)he amount of water necessary to irrigate the golf course, given its climate
3 and location, varies from approximately 1.6 to 2.2 million gallons per day.” (Dooge Dec.
4 9/14/07, ¶ 12.) WWC states a maximum contract amount of 4 mgd. (Exh. D-96, p. 4.) Hui/MTF
5 FOF E-57.

6 392. The 2.2 mgd figure came from a single month, October 2005, based on measurements at
7 the pump station (Dooge, Tr. 1/14/08, p. 152, ll. 8-21), which is less accurate than the meter at
8 the ditch intake that MMK normally uses, and which MMK “used to sometimes” consult only “if
9 the [ditch intake] meter was down.” (*Id.* p. 147, ll. 12-23; p. 148, ll. 15-18.) October 2005 fell
10 within the period toward the end of 2005 and continuing into 2006, during which MMK was
11 growing in the turf on both courses and thus “throwing out a lot of water on the golf courses,
12 more than we would normally.” (*Id.* p. 134, l. 20 to p. 135, l. 1.) MMK measured no other
13 month of such use (*id.* p. 152, l. 22 to p. 153, l. 2) and has never even projected the potential of
14 such use (*id.* p. 155, ll. 6-12). Hui/MTF FOF E-58.

15 393. MMK testified that 2006 would be the first year in which records would show a full year
16 of irrigation on all 36 holes. (Dooge, Tr. 1/14/08, p. 136, ll. 9-13.) Based on its subpoenaed
17 records, MMK used 1.2 (1.198) mgd in 2006 for 36 holes. (*Id.* p. 160, ll. 9-22; Exh. C-61.)
18 Hui/MTF FOF E-59.

19 394. MMK did not open both golf courses until May 2006 (Dooge, Tr. 1/14/08, p. 134, ll. 9-
20 12), and thus for the first several months of 2006 was “throwing a lot of water down,” “more
21 than normal,” “growing in part of the nine holes at Kahili, growing in the upper [Kamehameha]
22 course too.” (*Id.* p. 135, l. 22 to p. 136, l. 8.) Hui/MTF FOF E-60.

23 395. The 1.2 mgd figure paralleled the State of Hawai‘i Office of State Planning’s (“OSP”)
24 reported figure of 0.6 mgd each for the “Waikapu” and “Waikapu Slwd” courses, which are the
25 predecessors of the current courses. (Exh. C-49.) See Tr. 1/14/08 p. 132, ll. 4-11 (background of
26 prior course names). Although MMK first applied the figure for the “Maui Lani” course (Dooge,
27 Dec. 11/16/07, ¶¶ 8-9), it later admitted that the predecessor courses offered a more accurate
28 comparison than Maui Lani or other general figures, and that OSP’s reported figure of 1.2 mgd
29 was accurate. (Dooge, Tr. 1/14/08, p. 144, l. 2 to p. 145, l. 22.) Moreover, MMK has installed a
30 new irrigation and monitoring system, resulting in “greater efficiency in the use of water” and
31 lower use rates than before. (*Id.* p. 122, ll. 12-15; p. 168, ll. 9-20.) Hui/MTF FOF E-61.

1 396. MMK’s claim that Mr. Parabolicoli of Maui County advised it that reclaimed water is “not
2 feasible for irrigation of golf courses” (Dooge, Dec. 11/16/07, ¶ 18), is belied by the many years
3 of reclaimed water use on golf courses on Maui and throughout the state, from both public and
4 private plants. (Parabolicoli, Tr. 1/25/08, p. 137, l. 13 to p. 138, l. 10.) Contrary to MMK’s claim
5 that Mr. Parabolicoli advised that there was “no way” MMK could obtain reclaimed water (Tr.
6 1/14/08, p. 127, ll. 5-6), Mr. Parabolicoli has never been approached by any MMK representative
7 about using water from any reclamation facilities. (Parabolicoli, Tr. 1/25/08, p. 140, ll. 2-7.)
8 Hui/MTF, FOF.

9 397. “Farm plans” for Wailuku Country Estates (“WCE”) do not require agriculture, but
10 alternatively allow “conservation,” which involves landscaping activities like planting trees and
11 grass. (Irani, Tr. 1/14/08, p. 87, ll. 14-25; p. 24, ll. 10-11.) Hui/MTF FOF E-70.

12 398. WWC’s contract with WCE states a maximum delivery of 1 mgd to WCE (Exh. D-96, p.
13 6; Exh. D-92, § 1.7), which would amount to 5,435 gad for 184 lots. Hui/MTF FOF E-81.

14 399. Like other WWC customers, WCE pays a quarterly “minimum charge” for water,
15 regardless of what it actually uses. WCE automatically pays for 0.5 mgd a month. (Exh. D-92, §§
16 1.8, 1.7.) Hui/MTF FOF E-82.

17 400. WCE limits each lot owner to a daily average use of 2,200 gallons, which it stated is
18 “adequate.” (Irani, Tr. 1/14/08, p. 18, ll. 10-15; p. 92, ll. 1-2.). WCE “penalize[s]” lot owners
19 who exceed their “allotment” by imposing an extra charge for “any excess over the allowable
20 use.” (Irani, Tr. 1/14/08, p. 91, l. 25 to p. 92, l. 3; Exh. A-214, p. 1.) Hui/MTF FOF E-85, E-86.

21 401. In addition to water received from WWC, WCE lots receive up to 540 gpd from the
22 county system. (Irani, Tr. 1/14/08, p. 17, ll. 5-9.) Hui/MTF FOF E-84.

23 402. The County has accommodated agricultural development lots with 600 to 1,200 gpd, but
24 limits further allocations so as not to provide excessive amounts of water to developments not
25 engaged in bona fide agriculture. (Tr. 12/14/07 (Eng), p. 189, l. 13 to p. 190, l. 2; Tr. 12/14/07, p.
26 4, l. 25 to p. 5, l. 12.) Hui/MTF FOF E-74.

27 403. The County does not have a policy to encourage new subdivisions to use surface water
28 for irrigation, and Director Eng of the Maui County Department of Water Supply has made it
29 clear to his department not to encourage such use. (Eng, Tr. 12/14/07, p. 147, l. 24 to p. 148, l.
30 5.) Hui/MTF FOF E-73.

1 404. WCE's allocation of 2,200 gpd, plus the County's 540 gpd, equals 2,740 gpd, higher than
2 the 600 to 1,200 gpd the County provides to agricultural development lots. WCE claimed a
3 maximum amount of 100,000 gpd for its community park and roadside community areas, but
4 actual use was "a lot less," not "even half as much," because of the use of drought tolerant grass.
5 (Irani, Tr. 1/14/08, p. 55, l. 22 to p. 56, l. 1; p. 55, ll. 2-3; p. 53, l. 11 to p. 54, l. 3; p. 54, ll. 11-
6 14.). Hui/MTF FOF E-91, E-92, E-93.

7 405. Apart from the recycled water alternative discussed above, WCE recognizes it may
8 petition the County to use its municipal system as an "alternative source of water for WCE
9 irrigation purposes" and observes that "[s]ince the County of Maui allows other agricultural
10 property in central Maui to use [county] water, it is unlikely the County would deny such a
11 petition." (Irani, Dec. 11/16/07, ¶ 20.) Hui/MTF FOF E-94.

12 406. Koolau Cattle Company ("KCC") is another agricultural development, a 10-lot, 72-acre
13 subdivision called "Malaihi Ag" on Kahekili Highway in Waihe'e. (See Subpoena Duces Tecum
14 to Dwayne Betsill of KCC.) KCC is one of "about 40 companies" owned by the Betsill brothers,
15 who are in the business of construction and development. (Betsill, Tr. 1/25/08, p. 110, l. 22 to p.
16 111, l. 3; Betsill, Tr. 1/14/08, p. 201, ll. 11-20.) Hui/MTF FOF E-95, E-96.

17 407. WWC states a maximum contract amount for KCC of 100,000 gpd. (Exh. D-96, p. 4.)
18 KCC stated it had an agreement for 200,000 gpd: 100,000 on the Malaihi Ag. parcel, TMK No.
19 3-2-13-15; and 100,000 for a separate 113-acre parcel, TMK No. 3-2-9-1. (Betsill, Tr. 1/14/08, p.
20 210, ll. 1-11.) See also Exh. D-86, Exh A; Tr. 1/25/08, p. 107, ll. 16-25 (TMK numbers). But
21 KCC's agreement contemplates a maximum of 100,000 gpd for both parcels. See Exh. D-86, §
22 4.06 (defining "Property" as both parcels for water use purposes). Hui/MTF FOF E-97. Apart
23 from any water supplied by WWC, each lot in the Malaihi Ag. subdivision receives up to 1,000
24 gpd from the county system. (Betsill, Tr. 1/14/08, p. 204, l. 24 to p. 205, l. 5.) Hui/MTF FOF E-
25 98.

26 408. KCC substantiated only limited water uses on both parcels and provided no details on
27 acreages or water usages, even though each lot is supposedly metered. (Betsill, Tr. 1/14/08, p.
28 210, ll. 18-23.) Hui/MTF FOF E-99. KCC also has about eight acres of dryland taro on the 113-
29 acre parcel, as well as 17 to 21 cattle. (Betsill, Tr. 1/14/08, p. 203, l. 21 to p. 204, l. 2.) The 113-
30 acre parcel also contains remnant macadamia nut trees from the former Wailuku plantation, none
31 of which has been watered. (Id. p. 224, ll. 10-17.) KCC's dryland taro uses "minimal water"

1 through a drip system. (Id., p. 215, ll. 6-8.) KCC stated its water use on its total 9.25 acres of
2 dryland taro on both parcels as 15,000 to 20,000 gpd. (Id. p. 207, ll. 13-17.) Hui/MTF FOF E-
3 104, E-105. KCC noted a desire to develop the 113-acre parcel, but it has not proposed anything
4 yet after being turned down by the county because of a zoning “problem.” (Betsill, Tr. 1/25/08,
5 p. 107, ll. 4-13.) Hui/MTF FOF E-106.

6 409. Kihei Gardens & Landscaping (“KGL”) cultivates landscaping plants on 15 to 18 acres of
7 a 25.4 acre parcel in Waikapū (Waiale Road). (Okamura, Tr. 1/24/08, pp. 157-58.) WWC’s
8 records indicate average usage between 37,924 to 44,002 gpd (around 2,500 gad) from 2005 to
9 2007. (Exh. A-215.) KGL’s usage is projected to decrease as more and more native plants and
10 less water-consuming plants are being used. (Okamura, Tr. 1/24/08, p. 180, ll. 7-18.) Hui/MTF
11 FOF E-132, E-133, E-134.

12 410. KGL has “never considered” or looked into using county water. (Okamura, Tr. 1/24/08,
13 p. 160, ll. 3-5; p. 175, ll. 13-14), assuming this alternative would increase costs, because it
14 thought it buys water at a lower rate than county water. (Id. p. 160, ll. 20-23.) However, KGL
15 pays WWC \$0.85 per 1000 gallons (Exh. D-76, § 9), which is identical to the county rate as of
16 2006 (Exh. D-90, § 1.12.) Hui/MTF FOF E-135.

17 411. KGL has also only “thought about,” but never looked into, installing a well on its
18 property. (Okamura, Tr. 1/24/08, p. 160, ll. 9-16; p. 175, ll. 15-19.) Hui/MTF FOF E-136.

19 412. Melia Orchids (“MO”) is a orchid distribution business in Waikapū (Waiko Road)
20 cultivating 10 acres in Waikapū and 10 acres in Kula using another water source. (Schenk, Tr.
21 1/25/08, pp. 82-83, p. 88, l. 21 to p. 90, l. 3.) Hui/MTF FOF E-140, E-141.

22 413. WWC’s records indicate an average use of 8,185 to 8,585 gpd (about 840 gad) from 2005
23 to 2007. (Exh. A-216.) Hui/MTF FOF E-142.

24 414. MO has only a 30-day lease on the Waikapū parcel from the owner, A&B Properties,
25 with the understanding that the land is slated for development and a long-term lease would mean
26 the “rent would go way up.” (Schenk, Tr. 1/25/08, p. 98, l. 19 to p. 99, l. 4.) Hui/MTF FOF E-
27 144.

28 415. Various entities, including THP Associates and Waikapū Mauka Partners (collectively,
29 “THP/WMP”), which are represented by Howard Hamamoto, own 270 acres of land formerly
30 connected to the Waikapū golf courses. (Hamamoto, WDT 10/26/07, ¶ 4.) Hui/MTF FOF E-145.

1 416. THP/WMP’s development plans on the land remain in the “schematic,” “conceptual”
2 phase and involve “just tossing ideas around at this point.” (Hamamoto, Tr. 1/25/08, p. 33, ll. 6-
3 20.) Any development would require numerous state and county approvals, but THP/WMP have
4 not begun the first step of applying to the state Land Use Commission. (Hamamoto, Tr. 1/25/08,
5 p. 33, l. 6 to p. 34, l. 8.) Hui/MTF FOF E-146, E-147.

6
7 **4. HC&S**

8 417. Approximately 5,300 acres of HC&S’s sugar plantation, or about 15 percent of the
9 roughly 35,000 acres HC&S uses for sugar cane cultivation, are located in HC&S’s “West Maui
10 Fields,” which are within the “Maalaea Farm.” (Volner, Dec. 9/14/07, ¶ 3; Hew, Dec. 9/14/07, ¶
11 4; Holaday, Dec. 9/14/07, ¶ 4.) Hui/MTF FOF F-1.

12 418. The West Maui Fields consist of two groups of fields – the Waihe`e-Hopoi Fields and the
13 `Īao-Waikapū Fields. (Hew, Dec. 9/14/07, ¶¶ 4-6; Exh. E-1; Volner, Dec. 9/14/07, ¶ 3.)
14 Hui/MTF FOF F-2.

15 419. The Waihe`e-Hopoi Fields, which are owned by HC&S, are irrigated with water diverted
16 from Waihe`e River and Waiehu and `Īao Streams that is delivered to Waiale Reservoir by the
17 Spreckels Ditch and the Waihe`e Ditch via the Hopoi Chute. (Hew Dec. 9/14/07, ¶¶ 5, 10, 11,
18 12.) Hui/MTF FOF F-3.

19 420. The average amount of water delivered to the Waiale Reservoir between 1993 and July
20 2007, as calculated by combining the flows measured at the Wailuku gauging station at the
21 Spreckels Ditch and the Hopoi gauging station at the Waihe`e Ditch minus whatever water was
22 determined to have passed by the Hopoi Ditch, was approximately 39 mgd. This does not
23 include any water separately delivered by WWC to the `Īao-Waikapū Fields. (Hew, WDT
24 1/29/08, ¶ 12.) HC&S FOF 93.

25 421. HC&S received an average of 40.11 mgd in 2005 and 31.04 mgd in 2006 at Waiale
26 Reservoir. (Exh. E-3; Exh. E-4.) WWC FOF 255.

27 422. Of the amounts received at Waiale Reservoir, WWC estimates that it provided 29.14 mgd
28 of the 40.11 mgd in 2005 and 17.55 mgd of the 31.04 mgd in 2006. (Exh. A-138.) WWC FOF
29 256, 260.

1 **a. System Losses**

2 423. HC&S estimates that it loses 6-8 mgd through seepage from the Waiale reservoir,
3 depending on the level of the reservoir. Seepage throughout the rest of the HC&S ditch and
4 reservoir system is estimated to be 3-4 mgd. (Volner, WDT 9/14/07, ¶ 16.) HC&S FOF 96.

5 424. HC&S’ policy is to try to keep reservoir levels as low as possible and tries to maintain
6 the water level in Waiale Reservoir at a relatively constant level of approximately 12 feet, or 36
7 million gallons (“mg”). This level is not too close to the point where a sudden rain event would
8 cause the reservoir to overflow, but stores a reasonable amount of water to act as a buffer for
9 days when the ditch flows are low. HC&S tries to avoid letting the level drop below 9 feet, or 20
10 mg, because when the level is low, there is a greater risk of silt entering the irrigation system and
11 clogging the sand filters and irrigation tubes. Irrigation volume is therefore set as much as
12 possible to match outflows to inflows on a daily basis, adjusting for seepage and system losses.
13 (Volner, WDT 9/14/07, ¶ 12; Volner, Tr. 1/30/08, p. 58, ll. 7-17.) HC&S FOF 97.

14 425. HC&S acknowledges that “high density polyethylene lining could negate much of the
15 seepage, not all of it” and that concrete lining “is obviously another option.” (Volner, Tr.
16 1/30/08, p. 58, ll. 18-25; see also Exh. E-45, p. 2.) HC&S has no estimates of the cost to line
17 Waiale Reservoir or the other reservoirs and ditches and has undertaken no engineering or
18 financial analysis of what it would take to reduce the losses (Volner, Tr. 1/30/08, p. 59, ll. 6-17;
19 Holaday, Tr. 1/31/08, p. 135, l. 16 to p. 136, l. 14). Hui/MTF FOF F-116.

20 426. WWC estimated the losses from its ditch system as a set percentage of 7.34 percent,
21 based primarily on a 20-year old report, Exh. D-4A. (Suzuki, Tr. 12/14/07, p. 164, l. 11 to p. 165,
22 l. 23.) Hui/MTF FOF E-35.

23
24 **b. Irrigation Practices**

25 427. According to HC&S, the Waihe`e-Hopoi Fields comprise approximately 3,950 acres.
26 (Hew, Dec. 9/14/07, ¶ 5.) Although Fields 921 and 922 are within the geographical area of the
27 Waihe`e-Hopoi Fields, the approximately 300 acres included in Fields 921 and 922 are not
28 included in the 3,950-acres of the Waihe`e-Hopoi Fields because Fields 921 and 922 were
29 watered exclusively with wastewater from Maui Land and Pine (“MLP”) and did not use water

1 diverted from Nā Wai `Ehā streams during 2004 through 2006 except for flushing the drip lines.⁴
2 (Volner, Tr. 1/30/08, p. 27, l. 21 to p. 28, l. 12; p. 28, l. 24 to p. 28, l. 6.) Hui/MTF FOF F-4.
3 428. Of the 3,950-acre Waihe`e-Hopoi Fields, HC&S currently leases 600.2 acres to
4 Monsanto: 114.6 acres in Field 913; 240.1 acres in Field 904; and 245.5 acres in Field 908.
5 (Exh. A-197 (Exh. A); Exh. A-198, pp. HC&S 02021-02022, (Exhs. A, B); Exh. A-199; Holaday,
6 Tr. 1/31/08, p. 57, l. 8 to p. 58, l. 2; p. 60, l. 10 to p. 62, l. 2; p. 62, l. 23 to p. 64, l. 2.) Hui/MTF
7 FOF F-5.
8 429. Subtracting the land leased to Monsanto, the acreage of the Waihe`e-Hopoi Fields on
9 which HC&S grows sugar cane irrigated with water diverted from Nā Wai `Ehā streams is
10 approximately 3,350 acres. Hui/MTF FOF F-6. Adding the 300 acres of Fields 921 and 922,
11 which will no longer receive MLP wastewater, the total irrigated acres will be 3,650 acres.
12 430. The other group of West Maui Fields is the `Īao-Waikapū Fields, which include Field
13 920, an HC&S-owned field of which about 250 acres have been used for sugar cane cultivation,
14 and another thirteen fields, comprising 1080 acres (sometimes herein, the “leased fields”), that
15 HC&S leases from entities associated with Atherton, et al. for a total of approximately 1330
16 acres. (Hew, Dec. 9/14/07, ¶ 6; Volner, Tr. 1/30/08, p. 12, l. 4 to p. 13, l. 11; Exh. C-67 (Exh.
17 A).) Hui/MTF FOF F-7. In December, 2007, HC&S entered a verbal agreement with the
18 Atherton Hui, through Mr. Chumbley, to lease about 40 acres of the 129 acres of Field 767, as
19 though it had been part of the existing 1080-acre lease, thereby increasing the total acreage to
20 1370 acres for the `Īao-Waikapū Fields. (Volner, Tr. 1/30/08, p. 211, ll. 11-18; p. 212, l. 19 to p.
21 213, l. 17.) Hu/MTF FOF F-8.
22 431. The `Īao-Waikapū Fields are above Waiale Reservoir and beyond the reach of HC&S’s
23 irrigation system. (Hew, Dec. 9/14/07, p. 3; Volner WDT 9/14/07, p. 2; Tr. XVI 89, 180-181.)
24 WWC FOF 241.
25 432. The `Īao-Waikapū Fields can receive stream water from several sources: `Īao Stream via
26 the `Īao-Waikapū Ditch; Waikapū Stream via the South Waikapū Ditch; and Waihe`e River, and
27 Waiehu and `Īao Streams via the Waihe`e Ditch past the Hopoi Chute. (Hew Dec. 9/14/07, ¶¶ 6-
28 8.) Hui/MTF FOF F-9.

⁴ But see footnote to FOF 261, *supra*, where in the future, MLP’s wastewater will no longer be available.

1 433. HC&S pays WWC a flat fee per acre for water used on the `Iao-Waikapū Fields,
2 regardless of how much water is used; in 2005 that fee was \$300/acre/year. (Tr. 1/30/08
3 (Volner), p. 26, ll. 3-7; Exh. D-56, p. 4; Chumbley, Tr. 1/24/07, p. 41, ll. 3-18.) Hui/MTF FOF F-
4 10.

5 434. For HC&S's `Iao-Waikapū Fields ("Leased Fields"), WWC reported providing 9.98 mgd
6 during 2005 and 10.88 mgd during 2006. (Exh. A-138.) WWC FOF 260.

7 435. The reports of water deliveries to HC&S submitted by WWC to the Commission are not
8 based on meter readings. Instead, WWC calculates the number of gallons delivered to users other
9 than HC&S, and then attributes the balance to HC&S. As a result, water that was not actually
10 delivered to HC&S could be counted as delivered to HC&S. (Chumbley, Tr., 1/24/08, p. 136, l.
11 14 to p. 138, l. 23; Exh. A-140, p. 47.) HC&S FOF 91.

12 436. HC&S used an average of 6,828 gad or 22.87 mgd for the 3,350 acres of the Waihe'e-
13 Hopoi Fields that it irrigated with stream waters during 2004-2006. (The remaining 300 acres
14 were irrigated with MLP's wastewater.) While there are periods of time when the irrigation
15 needs of these fields are fully satisfied, the fields are typically at a substantial moisture deficit
16 during the summer months, when solar radiation is greater and ditch flows are low. (Volner,
17 WDT 9/14/07, ¶¶ 13-14, 16; Volner, Tr. 1/30/08, p. 66, ll. 7-20; Exh. E-5.) HC&S FOF 94.

18 437. HC&S does not regularly calculate and use gad in managing its operations, because
19 averages can misstate actual irrigation requirements. For example, HC&S could apply twice the
20 amount of water needed in the winter months and half the amount of water needed in the summer
21 months, and the average would indicate that an adequate amount of water is applied on an annual
22 basis. Yet, the sugarcane plant will not respond well, and the yields will be off. (Volner, Tr.
23 1/29/08, p. 196, l. 5 to p. 197, l. 5.) HC&S FOF 94 (footnote 1).

24 438. Usage was computed by using HC&S's water balance database for all the fields in the
25 Waihe'e Hopoi system, determining how many irrigations hours were charged to the fields, and
26 then multiplying it by the application rate. The figure was not based off of meter readings.
27 (Volner, WDT 9/14/07, ¶ 17.) HC&S FOF 94(D).

28 439. The irrigated acres also could fluctuate yearly, because HC&S could add acres that were
29 not in production previously and may take in more lands as it surveys field boundaries to
30 determine the actual boundaries of its fields. (Volner, Tr. 1/29/08, p. 198, l. 19 to p. 199, l. 1.)
31 HC&S FOF 94(A).

1 440. HC&S does not perform an accounting of deliveries versus usage on a daily basis in the
2 normal course of its business. (Volner, Tr. 1/29/08, p. 201, ll. 9-12.) HC&S FOF 94(E).

3 441. For 2004-2006, HC&S used an average of 7,716 gad for the 'Āao-Waikapū Fields or an
4 average of about 10.26 mgd for 1330 acres for the years 2004 -2006 (forty acres were added in
5 December 2007, FOF 430, *supra*). (Volner, WDT 9/14/07, ¶¶ 17-18; Exh. E-6.) HC&S FOF 95.

6 442. Use was calculated from HC&S records by multiplying the flow rates in the drip
7 irrigation system by the hours of operation. There is no significant issue of system losses other
8 than the assumed 80% delivery rate to the plants inherent in the drip system, since the water for
9 these fields is delivered by WWC directly to the fields rather than going through Waiale
10 Reservoir and HC&S' internal ditch system. (Volner, WDT 9/14/07, ¶ 17)

11 443. The figure is skewed somewhat, however, by the inclusion of Field 920, which has very
12 sandy soil and has consumed more water than the other fields because of its porosity and also
13 because of its use for seed cane. HC&S no longer farms Field 920. Volner, WDT 9/14/07, ¶ 18;
14 Volner, Tr. 1/29/08, p. 204, l. 18 to p. 205, l.5; Volner, Tr. 1/30/08, p. 160, ll. 4-6). Excluding
15 Field 920, HC&S used an average of 7,098 gad on the remaining 1080 acres, or 7.67 mgd for the
16 'Āao-Waikapū Fields for 2004, 2005, and 2006. (Volner, WDT 9/14/07, ¶ 19; Exhibit E-7.)

17 HC&S FOF 95(B), 95(C). (These fields now total 1120 acres; the forty acres of Field 767 was
18 added to the lease in December 2007 and not included in these 2004-2006 irrigation numbers.)

19 444. HC&S is able to satisfy the irrigation requirement for the 'Āao-Waikapū Fields more
20 consistently, because the available water for these fields per acre is greater than it is for the
21 Waihe'e-Hopoi Fields. As a result, historically these were among the highest yielding fields on
22 the plantation. (Volner, WDT 9/14/07, ¶ 19.) HC&S FOF 95(D). However, starting in about
23 2003, even though the 'Āao Waikapū Fields receive more water on a per-acre basis than the
24 Waihe'e-Hopoi Fields, the extra water does not result in a higher yield. (Volner, Tr. 1/30/08, p.
25 99, ll. 10-16.) Hui/MTF FOF F-100.

26 445. In the 1980s, HC&S installed a drip irrigation system in its fields at a total cost of
27 approximately \$30 million. Irrigating fields with drip tubes reduces water loss due to evaporation
28 and helps ensure that water applied to a field is actually delivered to the sugar cane plant. Under
29 drip irrigation, it is assumed that 80% of the water applied is delivered to the sugar cane plant.
30 This is a uniformity factor, not an efficiency factor. The uniformity factor allows one to assume
31 with a degree of confidence that 80% of all water is applied to all the sugarcane plants at the

1 same rate. It does not mean that 80% of the water is used by the plant, or that 20% of the water is
2 lost. (Volner, WDT 9/14/07, ¶ 10A; Volner, Tr. 1/29/08, p. 195, l. 6 to p. 196, l. 1.) HC&S FOF
3 99.

4 446. Water in the ditch passes into a takeoff and through a screen to filter out debris. The
5 water then gravity flows into a pipe or multiple pipes to sand media filters. Sand media filters are
6 pressurized vessels containing a bed of sand. Water is percolated through the sand under
7 pressure, filtering any impurities that are too large to be passed through drip emitters. Water then
8 flows through the outlet of the sand filters, generally into large main lines and then distributed
9 throughout the fields. (Volner, Tr. 1/29/08, p. 178, l. 7 to p. 179, l. 2.) Occasionally, the sand
10 filters need to be “back flushed” with water to remove collected debris. Where possible, HC&S
11 uses the discharged back flush water for irrigation, either by returning it to the irrigation ditches
12 or by applying it to cultivated fields through perforated plastic pipes. (Volner, WDT 9/14/07, ¶
13 10C; Volner, Tr. 1/29/08, p. 201, l. 23 to p. 202, l. 24.) HC&S FOF 100.

14 447. Agricultural water meters are installed to allow HC&S to check instantaneous flows. At
15 each acre in the field there is a pressure regulator and a control valve. If a break occurs in that
16 one acre section, HC&S can isolate that section and continue to run the rest of the field. The
17 water then enters drip tubing, which generally has an emitter every 36 inches. Water is
18 discharged from emitters at the rate of 0.6 gallons per hour. (Volner, Tr. 1/29/08, p. 179, ll. 3-
19 16.) HC&S FOF 101.

20 448. Because HC&S does not have the capacity to irrigate all of its fields simultaneously,
21 available irrigation water is applied in “rounds” to different fields in accordance with priorities
22 that are assigned to them by the farm managers. The highest priority is given to fields that are
23 being planted, the second priority to fields that are ripening, and the third priority to all other
24 fields (routine irrigation). A round of irrigation can consist of anywhere from 24 hours up to 72
25 hours of continuous irrigation. Sometimes it can be longer, as in germinating cane, or shorter, as
26 in fertilizing. At any given time, only a fraction of the fields are actually receiving water (Volner,
27 WDT 9/14/07 written direct testimony, ¶ 10B; Volner, Tr. 1/29/08, p. 183, ll. 11-24, p. 190, ll.
28 19-21, p. 191, ll. 17-24, p. 192, ll. 2-4.) HC&S FOF 102.

29 449. Sugarcane is cultivated by HC&S in accordance with a two-year crop cycle. The two-
30 year crop cycle helps HC&S reduce costs and maximize yields. The sugarcane plant requires
31 water throughout the crop cycle, but during the last six months before harvesting, the amount of

1 water applied to the plant is purposely reduced to induce the plant to accumulate sucrose. To
2 facilitate the entry of machinery into the fields for harvesting, the fields are usually not irrigated
3 at all approximately 40-60 days before harvest. (Volner, WDT 9/14/07, ¶ 8; Volner, Tr. 1/29/08,
4 p. 186, l. 1 to p. 187, l. 2.) HC&S FOF 103.

5 450. HC&S uses slightly more water on a newly planted seed cane field than on a crop field to
6 ensure one hundred percent germination. In addition, it takes longer for the water to move to the
7 seed piece in the sandier soils. (Volner, Tr. 1/30/08, p. 196, ll. 2-9.) Fares, called by Petitioners
8 as an expert in irrigation management, stated that under his water budget model, seed cane
9 requires 13 percent more water than crop cane, assuming three crop cycles of eight months
10 running consecutively across a 24-month period. (Fares, Tr. 2/15/08, p. 21, ll. 20-21 and p. 65, l.
11 21 to p. 67, l. 9.) HC&S FOF 104.

12 451. HC&S determines the irrigation needs by the daily evapo-transpiration rate, which is
13 defined as the loss of water from the soil both by evaporation and by transpiration from the
14 plants growing in the soil. The evapo-transpiration rate varies during the year, depending on
15 weather conditions, solar insolation, temperatures, humidity, and wind speed. In order to
16 maintain sugar yields, the sum of available rainfall plus irrigation water applied to the fields must
17 approach the evapo-transpiration rate to promote efficient growth. The evapo-transpiration rate
18 tends to be the highest during the months of May through September, which are the peak
19 growing, planting, and harvesting periods for the plantation. Adequately meeting evapo-
20 transpiration rates is directly correlated with crop yield potential. (Volner, WDT 9/14/07, ¶ 9.)
21 HC&S FOF 105.

22 452. HC&S employs a computerized water balance model to determine the irrigation
23 requirements of its fields. The water balance model essentially calculates a water budget that
24 accounts for “deposits” of water in the form of rainfall and irrigation and “withdrawals” in the
25 form of evapo-transpiration. HC&S uses its water balance model as a managerial prioritization
26 tool to determine what needs to be irrigated. It also tracks what is applied to the field. (Nakahata,
27 WDT 11/16/07, ¶ 3; Volner, Tr. 1/29/08, p. 185, ll. 23-25; Nakahata, Tr. 2/15/08, p. 168, ll. 3-
28 10.) HC&S FOF 106.

29 453. On a daily basis, HC&S collects evaporation data from fifteen major weather stations
30 situated across the plantation and rainfall data from rainfall stations. HC&S personnel input the
31 evaporation and rainfall data into the water balance model along with data on the soil moisture

1 storage for the fields and the number of irrigation hours applied. The model then applies the data
2 to a modified Penman equation. The result is the water status for each field. The model then
3 prioritizes the field based on which field should receive water next. (Volner, Tr. 1/29/08, p. 189,
4 l. 25 to p. 190, l. 12; Nakahata, Tr. 2/15/08, p. 169, l. 7 to p. 170, l. 15.) HC&S FOF 107.
5 454. Fares, Hui/MTF's expert witness, calculated the optimal irrigation requirements for sugar
6 cane grown on HC&S's fields using a computerized daily water budget model. (Fares, WDT
7 10/26/07, ¶¶ 1-5; Fares, Tr. 2/15/08 p. 20, ll. 6-9, p. 29, ll. 3-5; exh. A-80.) Hui/MTF FOF F-13.
8 455. Fares' model accounts for water going into the plantation system, and water leaving the
9 system as evapo-transpiration, overflow, runoff, excess due to drainage; and the storage
10 capability of the soil. The purpose of the model is to calculate the optimal irrigation requirements
11 for sugarcane grown in Central Maui. Fares explained that the optimal irrigation requirement is
12 the amount of irrigation water needed to keep the soil moisture level above the allowable water
13 deficit ("AWD"), which is a given percent of the soil moisture level at which the sugarcane plant
14 wilts and can no longer take water from the soil. Fares' model assumes that the AWD is 65
15 percent of the available soil water holding capacity ("ASWHC"). (Exh. A-80; Fares, Tr.
16 2/15/08, p. 30, l. 11 to p. 31, l. 2 and p. 59, l. 18 to p. 60, l. 2.1) The model is not intended to
17 determine how much irrigation water to apply on a daily basis. (Fares, Tr. 2/15/08, p. 31, ll. 3-
18 24.) HC&S FOF 108.
19 456. The computer program Fares used for his water budget methodology requires, as inputs,
20 historical rainfall data, evapotranspiration or pan evaporation data for as long a period as
21 available from the location in which the crop will be grown, and data regarding the soil
22 characteristics and crop parameters. (Fares, Tr. 2/15/08, p. 31, l. 25 to p. 32, l. 20.) The program
23 then calculates, over the historical period covered by the rainfall data, how much irrigation water
24 would have been required to grow the crop. (Fares, Tr. 2/15/08, p. 34, l. 20 to p. 35, l. 9.) The
25 results are statistically analyzed to determine, *inter alia*, average daily amount of irrigation water
26 needed in the wettest year (xmin) and the driest year (xmax) in the period of record, as well as
27 the amount of irrigation water that would have supplied the irrigation requirement between these
28 two extremes. (Exh. A-80, pp. 5-7; Fares, Tr. 2/15/08, p. 35, ll. 10-23.) Hui/MTF FOF F-16.
29 457. Table 10 summarizes Fares's requirements estimates for the Waihe'e- Hopoi and 'Iao-
30 Waikapū fields. Fares used an 80 percent probability for satisfying the crop's irrigation
31 requirements (80% of the time, or four out of five years), because it is the industry standard for

1 calculating crop water duties in both the government and private sectors, including the Hawai`i
2 Natural Resource Conservation Service of the United States Department of Agriculture.⁵ (Exh.
3 A-80, pp. 5-7; Fares, Tr. 2/15/08, p. 35, ll. 10-23.) Hui/MTF FOF F-17.

4 458. The data on soil characteristics that Fares used in his model were from the State of
5 Hawai`i Soil Survey published by the United States Department of Agriculture. (Exh. A-80, p.
6 3.) The crop parameters Fares used, including the crop coefficient for sugar cane, the wilting
7 point, and the root depth, were obtained from literature. (Fares, Tr. 2/15/08, p. 75, ll. 12-22.)
8 Hui/MTF FOF F-18.

9 459. Fares used 54 years of daily rainfall data from a NOAA National Climatic Data Center
10 weather station located in the direct vicinity of the fields in question. (Exh. A-80, p. 2; Exh. A-
11 80A; Exh. A-80B; Fares, Tr. 2/15/08, p. 35, l. 24 to p. 37, l. 20.) To account for the spatial
12 variability of the rainfall, Fares adjusted the rainfall data according to isohyets, or contour lines
13 demarcating spatial rainfall gradients, which were developed as part of the Hawai`i Rainfall
14 Atlas. (Fares, Tr. 2/15/08, p. 37, l. 25 to p. 40, l. 6; Exh. A-80C.) Hui/MTF FOF F-19.

15 460. Evapotranspiration (“ET”) can be calculated, in the absence of direct measurements, by
16 evaporation of water from an open pan with certain characteristics (pan evaporation, or PE),
17 which can then be correlated to the water demands of the specific crop. (Fares, Tr. 2/15/08, p. 41,
18 l. 18 to p. 42, l. 21; p. 80, l. 21 to p. 81, l. 8.) Hui/MTF FOF F-20.

19 461. Fares used site-specific historical pan evaporation data spanning almost a century, from
20 1894 to 1983, collected by the sugar industry and published in a Department of Land and Natural
21 Resources (“DLNR”) report prepared by Ekern and Chang, which reported historical monthly
22 mean pan evaporation values. (Exh. A-80, p. 2; Fares, Tr. 2/15/08, p. 47, l. 1 to p. 48, l. 23.)
23 Hui/MTF FOF F-21.

⁵ For example, for the Waihe`e-Hopoi Fields, Fares calculated that 5674 gad would satisfy irrigation requirements 80% of the time. At 5317 gad, irrigation requirements would be satisfied 50% of the time, so 5674 gad at the 80% rate would be at least 357 gad or more than needed for 50% of the time. Similarly, 6005 gad would satisfy irrigation requirements 100% of the time, and at the 80% rate of 5674 gad, up to 331 gad more would be needed to satisfy the irrigation requirements for the remaining 20% of the time. Finally, at the 100% rate, even though all acres would receive sufficient water all 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 5674 gad, daily irrigation requirements of 6005 gad could be applied and be offset by days when the requirements were less than 5674 gad, as long as the 12-MAV stays within the range of 5674 gad.

1 462. To calculate the crop evapotranspiration (ET_c) from the measured pan evaporation, the
2 two-step methodology employed by Dr. Fares uses a reference crop, in this case a grass 15 cm
3 above ground that is not stressed and has no diseases. The potential, or reference, ET (ET_o) is
4 calculated using the equation $ET_o = PE \times K_p$, where PE is the measured pan evaporation and K_p
5 is the pan coefficient for the reference crop. The crop ET (ET_c) is then calculated using the
6 equation $ET_c = K_c \times ET_o$, where K_c is a crop coefficient specific to the crop being grown, in this
7 case, sugar cane, that varies over the growth cycle of the crop, and is available from peer-
8 reviewed literature. (Fares, Tr. 2/15/08, p. 43, l. 8 to p. 44, l. 7; p. 45, l. 4 to p. 46, l. 25; Exh. A-
9 80, p. 2.) Hui/MTF FOF F-22.

10 463. Fares ran his water budget program on each of the four TMK parcels comprising HC&S's
11 `Īao-Waikapū Fields and the three TMK parcels comprising HC&S's Waihe`e-Hopoi Fields.
12 (Exh. A-80, pp. 6-7.) Given that HC&S plants sugar cane year-round, Fares accounted for
13 variations in the optimal irrigation requirements based on the month in which a crop was planted
14 by running the model 12 times for each TMK, to simulate a crop planted in each month of the
15 year, and averaging the results. (Exh. A-80, p. 5.) Hui/MTF FOF F-26.

16 464. For the Waihe`e-Hopoi Fields, Fares's water budget program calculated that the optimal
17 irrigation requirement over the 54-year period of rainfall data ranged between 4,211 gad (xmin)
18 in the wettest year during that period and 6,005 gad (xmax) in the driest year, and that 5,674 gad
19 would satisfy the optimal irrigation requirements for sugar cane grown in the Waihe`e-Hopoi
20 Fields in 80% of those 54 years. (Exh. A-80, p. 6.) Hui/MTF FOF F-27.

21 465. For the `Īao-Waikapū Fields, Fares's methodology calculated that the optimal irrigation
22 requirements over the same 54-year period of record ranged between 3,648 gad (xmin) in the
23 wettest year during that period and 5,558 gad (xmax) in the driest year, and that 5,150 gad would
24 satisfy the optimal irrigation requirements for sugar cane grown in the `Īao-Waikapū Fields in
25 80% of those 54 years. (Exh. A-80, p. 7.) Hui/MTF FOF F-28.

26 466. Fares also divided his calculations of the optimal irrigation requirements for the `Īao-
27 Waikapū Fields into Field 920 and the leased fields. For Field 920 (TMK No. (2) 3-8-5-23), the
28 optimal irrigation requirements over the 54-year period of record ranged between 4,443 gad
29 (xmin) in the wettest year and 6,109 gad (xmax) in the driest year; and 5,752 gad would satisfy
30 the optimal irrigation requirements for sugar cane grown in Field 920 in 80% of those 54 years.
31 (Exh. A-80, p. 7.) Hui/MTF FOF F-29.

1 467. When the weighted averages for the `Iao-Waikapū Fields are recalculated to exclude
2 Field 920, the optimal irrigation needs of the leased fields over the period of record range
3 between 3,483 gad (xmin) in the wettest year and 5,444 (xmax) in the driest year; and 5,026 gad
4 would satisfy the optimal irrigation requirements 80% of the time. (Exh. A-80, p. 7.) Hui/MTF
5 FOF F-30.

6 468. HC&S experts were of the opinion that the Fares model is conceptually similar to HC&S'
7 water balance model, but different in significant respects. (Nakahata, Dec. 11/16/07, ¶ 5.) For
8 the input of rainfall, Fares used 54 years of rainfall data collected from the Pohakea Bridge
9 Station 307.2 operated by the National Climatic Data Center, and adjusted the data to account for
10 spatial variability of rainfall in the specific geographic area where the model is being applied.
11 To perform the adjustment, Fares multiplied the data by the ratio between the isohyets going
12 through Station 307.2 and the isohyets going through the midpoint of the subject property. Fares
13 then took the mean and median of the historical rainfall data. (Exh. A-80, pp. 2, 5; Exh. A-80A;
14 Exh. A-80C; Fares, Tr. 2/15/08, p. 35, l. 24 to p. 39, l. 12.) Ogoshi, an Associate Agronomist at
15 the University of Hawai'i at Manoa, Department of Tropical Plant and Soil Sciences and a
16 colleague of Fares, testified that Fares' method of interpolating data to approximate local
17 conditions has not been tested for accuracy. (Ogoshi, Tr. 2/20/08, p. 165, l. 22 to p. 166, l. 17.)
18 HC&S FOF 109.

19 469. Unlike the Fares model, HC&S relies on real-time data collected at its weather stations to
20 determine its daily irrigation requirements. HC&S collects data from its 41 rain stations and 15
21 evaporation stations located throughout the plantation; four of the rain stations and two of the
22 evaporation stations are located in the West Maui Fields. (Nakahata, Dec. 11/16/07, ¶ 7.) Real-
23 time data is more reliable than long-term daily averages in helping to determine, on any given
24 day, the amount of moisture replacement the soils need in order to optimize the growth of the
25 sugarcane. For example, a daily average over the course of a month in which it rained very
26 heavily for just a few days would lead to under irrigating for the majority of the month. Further,
27 during extended periods of low rainfall, relying on historic averages would result in under
28 irrigating for most of the year. (Nakahata, Dec. 11/16/07, ¶ 6; Ogoshi, Dec. 11/16/07, ¶ 5.)
29 HC&S FOF 110.

30 470. For the input of evaporation, the Fares model engages in a two-step process. The first
31 step is to calculate the reference evapo-transpiration (ET_0), which is the evapo-transpiration rate

1 for a reference crop. The reference crop is grass with 15 centimeters above the ground when
2 water is not stressed. The ET_O is calculated by multiplying pan evaporation (PE) by a pan
3 coefficient for the reference crop (K_p). Fares used 0.8 as the pan coefficient for sugarcane. The
4 second step in the process is to multiply the ET_O by the crop coefficient (K_C) for sugarcane,
5 which in Fares's model increases linearly from 0.4 at planting to 1.25 as the crop develops to the
6 point of peak growth, then decreases linearly to 0.75 at the end of the growing season. (Exh. A-
7 80, p. 2; Fares, Tr. 2/15/08, p. 43 l. 8 to p. 45, l. 3.⁶) HC&S FOF 111.

8 471. Unlike the Fares model, which uses a pan coefficient of 0.8, HC&S's water balance
9 model does not apply a pan coefficient, but rather, applies the crop coefficient directly to the pan
10 evaporation value. HC&S's crop coefficient starts at 0.4 and reaches a maximum of 1.0, in
11 contrast to Fares's crop coefficient of 0.4 to a maximum of 1.25. (Nakahata, Tr. 2/15/08, p. 171,
12 ll. 11-25; Nakahata, Tr. 2/20/08, p. 33, ll. 18-19.) HC&S based its method on studies done
13 within the sugarcane growers industry, such as:

14 A. Ekern & Chang, Pan Evaporation: State of Hawai'i, 1894-1983 (1985)
15 (Exh. E-35, pp. 49-50; Nakahata, Tr. 2/15/08, p. 171, ll. 11-25; Nakahata, Tr. 2/20/08, p.
16 33, ll. 18-19);

17 B. Cornelison & Humbert, Irrigation Interval Control in the Hawaiian Sugar
18 Industry (1960) (Exh. E-36; Nakahata, Tr. 2/15/08, p. 175, ll. 1-25; Nakahata, Tr.
19 2/20/08, p. 43, l. 12 to p. 43, l. 18);

20 C. Santo & Bosshart, Amounts of Water Versus Yield Relationships of Drip-
21 Irrigated Sugarcane (1982) (Exh. E-38, p. 6, Figure 1; Nakahata, Tr. 2/15/08, p. 178, ll.
22 14-23);

23 D. Santo & Beminzer, Effects of Irrigation and Nitrogen on Yields of Drip-
24 Irrigated Sugarcane (Exh. E-39, Nakahata, Tr. 2/15/08, p. 181, l. 15 to p. 182, l. 13);

25 E. Chang, Campbell, Brodie, & Baver, Evapotranspiration Research at the
26 HSPA Experiment Station (Exh. E-42, p. 13);

27 F. Jones, A Review of Evapotranspiration Studies in Irrigated Sugarcane in
28 Hawaii (1980) (Exh. E-32, p. 198)

⁶ Exhibit A-80 identifies Fares's crop coefficient as 0.7, but in his oral testimony, Fares corrected this to 0.8.

1 HC&S calculates the crop coefficient using a leaf area index curve developed by a researcher at
2 the Hawaii Sugar Planters Association it retained in the late 1980's. (Nakahata, Tr. 2/5/08, p. 170,
3 l. 16 to p. 171, l. 10, p. 172, ll. 1-4.) HC&S FOF 112.

4 472. Fares relied on evaporation data reported in Ekern & Chang (1985), which only go up
5 until 1983. (Exh. E-35.) Because Fares calculated outputs from his model up to 2004, it appears
6 that the evaporation figures he used for 1983 to 2004 are monthly means calculated from data
7 prior to 1983. However, using monthly means might not accurately reflect inter-annual variations
8 in rainfall which in turn correlate with variations in pan evaporation. (Ogoshi, Tr. 2/20/08, p. 168,
9 l. 19 to p. 169, l. 23.) HC&S FOF 113.

10 473. In calculating the gross daily optimal irrigation requirement, the Fares model assumes
11 irrigation efficiency of 85% for drip irrigation. Fares defined irrigation efficiency as the
12 percentage of water that will be delivered to the plant. Thus, irrigation efficiency of 85%
13 assumes that of 100 gallons pumped, 85 gallons will be delivered to the plant. According to
14 Fares, 85% irrigation efficiency is the industry standard. (Fares, Tr. 2/15/08, p. 51, l. 17 to p. 53,
15 l. 6.) Fares had no opinion on whether HC&S's irrigation practices are efficient or inefficient.
16 (Fares, Tr. 2/15/08, p. 146, ll. 13-16.) HC&S also takes into account the different types of tubing
17 used in the field, the length of the tubes, and variations in topography. Therefore, HC&S uses an
18 80% efficiency factor. (Nakahata, Tr. 2/15/08, p. 191, l. 18 to p. 192, l. 11 and p. 196, l. 10 to p.
19 197, l. 8.) HC&S FOF 114.

20 474. One of the parameters used in the Fares model is crop growth stage. (Exh. A-80, p. 3;
21 Fares, Tr. 2/15/08, p. 87, ll. 17-24.) For this parameter, Fares relied on values coinciding with
22 those reported for sugarcane in FAO Irrigation and Drainage Paper No. 56, Crop
23 Evapotranspiration. ("FAO Paper No. 56"), Table 11 (Exh. E-31, p. 107, Table 11; Fares, Tr.
24 2/15/08, p. 93, ll. 5-21.) FAO Paper No. 56 cautions that the values in Table 11 are to be used as
25 guides, and should be checked against local conditions:

26 " [t]he values in Table 11 are useful only as a general guide and for
27 comparison purposes. The listed lengths of growth stages are average lengths for
28 the regions and periods specified and are intended to serve only as examples.
29 Local observations of the specific plant stage development should be used,
30 wherever possible, to incorporate effects of plant variety, climate and cultural
31 practices. Local information can be obtained by interviewing farmers, ranchers,

1 agricultural extension agents and local researchers, by conducting local surveys,
2 or by remote sensing. When determining stage dates from local observations, the
3 guidelines and visual descriptions may be helpful.

4 (Exhibit E-31 at 108.) HC&S FOF 115.

5 475. Fares reviewed literature relating to growing sugarcane in Hawai'i. He did not, however,
6 observe or study the conditions specific to HC&S's fields. (Fares, Tr. 2/15/08, p. 23, ll. 19-22, p.
7 141, l. 24 to p. 143, l. 12, p. 102, l. 17 to p. 104, l. 2.) HC&S FOF 116.

8 476. Fares has not personally visited the fields or inspected HC&S' irrigation system. He has
9 never done any field work concerning the irrigation of sugarcane nor has he studied the actual
10 usage of water for sugarcane. (Fares, Tr. 2/15/08, p. 23, ll. 19-22, p. 28, ll. 2-10, 21-24, p. 141, l.
11 24 to p. 143, l. 12.) HC&S stressed the importance of basing water management on conditions in
12 the field rather than on models. (Volner, Tr. 1/29/08, p. 211, l. 14 to p. 213, l. 22, p. 214, l. 23 to
13 p. 216, l. 10.) HC&S FOF 117.

14 477. Fares' model and the generalizations drawn from it do not necessarily track actual
15 conditions and practices in HC&S's West Maui Fields. For example, Fares' model does not
16 account for water that must be run through the irrigation system to detect leaks. (Nakahata, Tr.
17 2/15/08, p. 202, l. 9 to p. 203, l. 7.) The model also fails to account for irrigation water "lost"
18 because it is applied just before it rains. (Nakahata, Tr. 2/15/08, p. 203, ll. 8-23.) HC&S FOF 118.

19 478. Fares' model assumes it is always practical for a sugarcane grower to apply irrigation
20 water to a field to restore its soil moisture storage level to 100 percent once it depletes to 65
21 percent. (Fares, Tr. 2/15/08, p. 132, ll. 15-25.) In practice, irrigation water may not necessarily be
22 available at the point the soil moisture level reaches 65 percent. Especially in the dry summer
23 months, fields could go for weeks without being irrigated. (Nakahata, Tr. 2/15/08, p. 187, ll. 4-
24 22.) Moreover, because HC&S does not operate 24 hours a day, it may not necessarily have
25 enough personnel on hand to shut water off to fields precisely at the point when the soil moisture
26 reaches 100 percent. (Nakahata, Tr. 2/15/08, p. 189, l. 22 to p. 191, l. 7.) Therefore, if significant
27 flows in the ditches are available, HC&S might intentionally irrigate in excess of the amount
28 needed to restore the soil moisture level to 100 percent to create a reserve of water that can be
29 tapped by the deeper part of the root zone in times of drought. (Nakahata, Tr. 2/20/08, p. 20, ll.
30 9-22.) HC&S FOF 119.

1 479. HC&S's water balance model considers the root zone to be where the majority of the
2 roots are, which is at the approximate depth of two feet, but the roots could actually extend as
3 deep as six feet. Nakahata testified about her observations of experiments conducted on HC&S
4 Fields 921 and 922 in which lysimeters were installed at six feet depth and did not receive any
5 water. Thus, although the water balance model would consider water going beyond the majority
6 root zone to be "lost," it could still be available to the plant. This is the case even in fields with
7 sandier soils, because moisture-retaining soil (such as loam) could lie beneath the sandy soil
8 surface where the majority root zone resides. (Nakahata, Tr. 2/15/08, p. 21, ll. 11-14, p. 24, l. 14
9 to p. 26, l. 17, p. 29, l. 7 to p. 30, l. 24, p. 31, ll. 16-19.) HC&S FOF 119 (footnote).

10 480. HC&S will deviate from its water balance model as dictated by field conditions and other
11 practical requirements. For example, HC&S does not rely strictly on the crop coefficient in the
12 initial phase of crop growth. When a field is first planted, the primary objective is to keep the
13 seed piece moist so as to ensure germination. (Volner, Tr. 1/29/08, p. 192, l. 21 to p. 193, l. 6;
14 Nakahata, Tr. 2/15/08, p. 185, ll. 14-18.) Water also needs to be applied constantly in the initial
15 stage of growth to keep away the lesser cornstalk borer (*elasmopalpus lignosellus*) from boring
16 into the shoots. (Nakahata, Tr. 2/15/08, p. 185, l. 19 to p. 186, l. 7; Nakahata, Tr. 2/20/08, p. 91,
17 ll. 15-23.) Therefore, in the first six weeks to two months of a crop, HC&S might irrigate above
18 the amount correlated to the 0.4 crop coefficient that its water balance model uses for the initial
19 stage of a crop. (Nakahata, Tr. 2/15/08, p. 186, ll. 8-12.) Once a crop reaches the ripening state,
20 the amount of water applied is no longer determined by evapo-transpiration. Instead, HC&S
21 takes cane samples to determine when to irrigate the field. (Nakahata, Tr. 2/15/08, p. 184, ll. 6-
22 14; Volner, Tr. 1/29/08, p. 192, ll. 14-20.) Other reasons for applying water to the fields besides
23 replacing moisture lost to evapotranspiration include application of fertilizer and herbicides.
24 (Volner, Tr. 1/29/08, p. 193, ll. 12-17, p. 193, l. 22 to p. 194, l. 15.) HC&S FOF 120.

25 481. Fares has attempted to validate his model by comparing the optimal irrigation
26 requirements calculated using the model to water duties for Hawai'i crops recommended by the
27 National Resources and Conservation Services ("NRCS") of the U.S. Department of Agriculture.
28 (Fares, Tr. 2/15/08, p. 133, l. 18 to p. 136, l. 13.) The NRCS recommendations are not published
29 or peer reviewed. (Fares, Tr. 2/15/08, p. 137, ll. 3-11.) Moreover, the NRCS recommendations
30 do not report data taken from the field. Thus, attempting to validate a model with the NRCS
31 recommendations amounts to comparing one modeling methodology to another. (Fares, Tr.

1 2/15/08, p. 137, l. 15 to p. 138, l. 1.) Proper validation of a model requires comparison to an
2 independent data set based on sugarcane grown in the field. (Fares, Tr. 2/20/08, p. 163, l. 16 to p.
3 164, l. 19.) HC&S FOF 121.

4 482. HC&S' actual water usage for the West Maui Fields in 2004 through 2006 is higher than
5 the optimal irrigation requirements computed by Fares under his model. (Exh. A-80, pp. 6-7.)
6 However, Fares declined to opine that HC&S is over-irrigating its fields. Fares would only say
7 that under his model, the optimal irrigation requirement is less than what HC&S actually used in
8 2004 through 2006. (Fares, Tr. 2/15/008, p. 143, l. 20 to p. 144, l. 9.) HC&S FOF 122.

9 483. 2004 to 2006 were low rainfall years. (Exh. E-52.) Thus, it is plausible for 2004 to 2006
10 data to lie outside the probabilities generated from 1930-1983, which is the period of the data set
11 that Fares relied on for the rainfall input of his model. (Ogoshi, Dec. 11/16/07, ¶ 6; Ogoshi, Tr.
12 2/20/08, p. 202, l. 23 to p. 203, l. 17.) HC&S FOF 122 (footnote).

13 484. During the peak growth period the product of Dr. Fares's pan coefficient (0.8) and crop
14 coefficient (1.25) is the same as HC&S's crop coefficient of 1.0 (HC&S does not use a pan
15 coefficient, FOF 471, *supra*). In the rest of the growth cycle, HC&S's method would apply more
16 water in the initial growth stages for crops planted in the summer,⁷⁷ but HC&S does not use its
17 water balance model during ripening, which starts six months before harvest, during which the
18 cane uses "very, very little water," and drying, which begins forty to sixty days before harvest,
19 when HC&S does not apply any water at all. In contrast, Fares's method decreases the irrigation
20 linearly for the six months before harvest, decreasing the crop coefficient from 1.25 to 0.75, and
21 would continue applying irrigation water during drying. (Exh. A-80; Fares, Tr. 2/15/08, p. 29, ll.
22 20-22 and p. 171, ll. 8-10, 20-22; Exh. C-80; Nakahata, Tr. 2/20/08, p. 54, l. 4 to p. 55, l. 2; p.
23 68, l. 24 to p. 72, l. 7; Hew, Tr. 1/29/08, p. 84, ll. 8-10; Exh. C-78 (Exh. F), p. 2.) Hui/MTF FOF
24 F-34.

25 485. In response to Ogoshi's criticism that real-time weather data is superior to historical long
26 term data (Ogoshi, Dec. 11/16/07, ¶ 5) and his suggestion that using HC&S's 2004 through 2006

⁷⁷ HC&S uses a crop coefficient of 0.4 in the initial growth stages and does not use a pan coefficient. Fares uses the same crop coefficient in the initial growth stages, but also applies a pan coefficient of 0.8, resulting in multiplying the pan evaporation rate by 0.32. HC&S multiplies the pan evaporation rate by 0.4, or about 25% ($.08/.32 = 25\%$) more than in Fares's model. HC&S also states that it might irrigate above the amount correlated to its 0.4 crop coefficient to keep the seed piece moist and to keep away the lesser cornstalk borer. FOF 480, *supra*.

1 weather data may result in a higher optimal irrigation requirement for those years, Fares
2 compared HC&S's evaporation and rainfall data from 2004 through 2006 with the long term
3 data, and determined that on both the Waihe'e-Hopoi Fields and the 'Īao-Waikapū Fields, the
4 mean rainfall for 2004 through 2006 was actually higher than the mean rainfall over the 54-year
5 period of record and the mean evaporation was lower. (Fares, Tr. 2/15/08, p. 40, ll. 7-23; p. 49, l.
6 25 to p. 51, l. 16; Exh. A-80D; Exh. A-80E.) Accordingly, Fares's water balance program
7 calculated a lower optimal irrigation requirement for the Waihe'e-Hopoi Fields using HC&S
8 2004 through 2006 weather data than it did using the long-term weather data. (Exh. A-80F; Fares,
9 Tr. 2/15/08, p. 58, l. 18 to p. 59, l. 7.) Hui/MTF FOF F-39.

10 486. Another difference between Fares and HC&S, which also results in Fares's model
11 calculating a higher optimal irrigation requirement than HC&S's model, is depth of the root zone
12 irrigated. Fares's calculations are based on irrigating a root zone which is initially 18 inches deep
13 at planting, increases to 36 inches deep by the end of the first year, and remains at 36 inches deep
14 throughout the second year. (Exh. A-80, p. 3.) (Fares' model overstates irrigation needs in the
15 early growth stages by calculating the irrigation requirements to a depth of 18 inches, because at
16 planting, the seed pieces have no roots.) HC&S calculates irrigation need for a root zone that is a
17 maximum of two feet deep. During the initial crop growth stages, HC&S reduces that depth by
18 applying the crop coefficient. (Nakahata, Tr. 2/20/08, p. 32, ll. 11-16; p. 18, l. 8 to p. 19, l. 6.)
19 Hui/MTF FOF F-41.

20 487. Ogoshi, HC&S's expert, did not analyze HC&S's water balance model or irrigation
21 records, and so, notwithstanding his disagreement with Fares's results to the extent they
22 indicated that HC&S had overirrigated the Waihe'e-Hopoi Fields and 'Īao-Waikapū Fields in
23 2004 through 2006, Ogoshi did not reach any conclusion that HC&S did not overirrigate those
24 fields during that period; he did not know one way or the other. (Ogoshi, Tr. 2/20/08, p. 178, ll.
25 15-25.) Hui/MTF FOF F-52.

26 488. Fares concluded that the only difference that results in his model calculating lower
27 optimal irrigation requirements than HC&S's is the choice of irrigation efficiency. (Fares, Tr.
28 2/15/08, p. 51, l. 17 to p. 52, l. 9; p. 128, ll. 7-9; Nakahata, Tr. 2/20/08, p. 72, l. 8 to p. 74, l. 7.)
29 In running his program, Fares selected 85 percent for the irrigation efficiency. (Exh. A-80, p. 3
30 (Table 1); Fares, Tr. 2/15/08, p. 127, ll. 21-24.) Although drip irrigation can have irrigation
31 efficiency greater than 90 percent, Fares selected 85 percent because it is the irrigation industry

1 standard and the minimum efficiency for which drip irrigation systems are designed. (Tr. 2/15/08
2 (Fares), p. 52, l. 10 to p. 53, l. 6; p. 127, ll. 21 to p. 128, l. 3; p. 132, ll. 1-11.) For the purpose of
3 its water balance program, HC&S assumes that “under drip irrigation . . . 80 percent of the water
4 applied gets to the cane plant.” (Exh. C-78 (Exh. F), p. 1; Volner, Dec. 9/14/07, ¶ 10.A.)
5 Hui/MTF FOF F-42, F-43, F-44.

6 489. According to Nakahata, the 80 percent irrigation efficiency assumption was provided by
7 HC&S’s engineers. (Nakahata, Tr. 2/15/08, p. 198, ll. 18-24.) Volner and Nakahata agreed that
8 the 80 percent efficiency (or uniformity) assumption has been used since before either of them
9 started with HC&S; neither is aware of any actual measurements or studies conducted by HC&S
10 to verify the assumption. (Nakahata, Tr. 2/20/08, p. 74, ll. 8-11, p. 76, ll. 21 to p. 77, l. 1; Volner,
11 Tr. 1/30/08, p. 84, l. 22 to p. 85, l. 3; p. 88, ll. 1-4.) Hui/MTF FOF F-48.

12 490. The evidence HC&S provided of its actual water requirements, as opposed to its water
13 use, was not from its water balance model. Volner testified that, by “historical daily
14 requirement,” he meant “the historical evapotranspiration for the Waihe`e-Hopoi fields which is
15 based on historical records of Field 906. . . . It is what was actually required by the weather
16 conditions.” (Volner, Tr. 1/30/08, p. 67, ll. 2-6, p. 68, ll. 5-6.) The data from HC&S’s weather
17 stations, including the station at Field 906, is evaporation data, not a measurement of
18 evapotranspiration (which, in HC&S’s method, is calculated by applying a crop coefficient but
19 not a pan coefficient to the evaporation data). (Exh. A-80E; Nakahata, Dec. 11/16/07, ¶ 7;
20 Nakahata, Tr. 2/20/08, p. 78, l. 24 to p. 79, l. 11; p. 83, l. 18 to p. 84, l. 19; Nakahata, Tr.
21 2/15/08, p. 166, ll. 11-13; p. 173, ll. 4-9; Volner, Dec. 9/14/07, ¶ 9.) Hui/MTF FOF F-54.

22 491. To calculate the “historical daily requirement of 6,826 gad” for the Waihe`e-Hopoi
23 Fields, Volner testified that HC&S used 0.25 inches as the average of the historical evaporation
24 measured at Field 906, multiplied it by 27,152 to convert it to gallons, and then divided by the
25 acreage. (Volner, Tr. 1/30/08, p. 67, ll. 7-12.) 6,826 gad is HC&S’s conversion of the historical
26 daily evaporation at Field 906, which is measured in inches, into gallons per acre. (Volner, Tr.
27 1/30/08, p. 174, ll. 8-12.) Hui/MTF FOF F-55.

28 492. HC&S’s calculation does not account for rainfall but assumes that all of the water lost
29 through evapotranspiration must be replaced by irrigation. (Volner, Tr. 1/30/08, p. 67, ll. 16.)
30 Efficient growth and sugar yields are maintained when the sum of the available rainwater plus

1 irrigation water approach the evapotranspiration rate. (Volner, Dec. 9/14/07, ¶9.) Hui/MTF FOF
2 F-56.

3 493. Using the daily average evaporation as a measure of water need also does not take into
4 consideration the growth stage of the crop (both Fares' and HC&S's models use a crop
5 coefficient that varies with crop cycle to calculate the evapotranspiration) and thus overestimates
6 irrigation requirements by assuming that, at any given time, all of the Waihe'e-Hopoi Fields are
7 in the maximum growth stage in which evapotranspiration is roughly equal to pan evaporation.
8 Use of daily average evaporation as a measurement of need does not account for fields that use
9 less than the evaporation rate because they are in the initial growth stage, ripening, or drying
10 (See Exh. C-80), or fields that are not using water because they are between harvest and planting,
11 a period that can range from several weeks to several months (Volner, Tr. 1/30/08, p. 23, l. 13 to
12 p. 24, l. 10.) Hui/MTF FOF F-57.

13

14 **c. Alternative Water Sources**

15 494. **HC&S's Well No. 7.** From 1927 until additional Nā Wai `Ehā water became available in
16 the 1980s, HC&S's primary source of irrigation water for its Waihe'e-Hopoi Fields was Well No.
17 7 (USGS No. 16), a brackish water well. (Volner, Tr. 1/30/08, p. 107, ll. 6-12; Exh. A-143, pp.
18 127, 156 (map), ¶ 4.) Hui/MTF FOF F142.

19 495. Between 1927 and 1985, HC&S pumped an average of about 21 mgd from Well No. 7.
20 (Exh. A-148, pp. 1-2, 5.) Since the additional Nā Wai `Ehā flows became available, HC&S has
21 minimized its use of Well No. 7 (Volner, Dec. 9/14/07, ¶ 7) but used it heavily on two occasions;
22 e.g., for the six-month period from June through November of 1996, an average of 25 mgd was
23 pumped (Exh. A-148, p. 3); and for the six-month period from May through October of 2000, an
24 average of 18.9 mgd was pumped. (Exh. A-148, p. 3.) Hui/MTF FOF F-143.

25 496. Well No. 7 is currently configured with three pumps: pumps 7A and 7B are at water
26 level and can each pump 17.5 mgd to ground level, and pump 7C is a booster pump at ground
27 level which can pump 14 mgd from pump 7A up to HC&S's Waihe'e Ditch, from which the
28 water can be distributed to all of the Waihe'e-Hopoi Fields except for the 175-acre Field 715.
29 (Volner, Tr. 1/29/08, p. 176, ll. 1-25; Volner, Tr. 1/30/08, p. 180, ll. 7-8.) Without using pump
30 7C, water from Well No. 7 can reach Fields 904, 908, and 909, which total approximately 800
31 acres. (Tr. Volner, 1/30/08, p. 35, ll. 4-12.) Hui/MTF FOF F-144. HC&S FOF 132.

1 497. According to HC&S, as currently configured, Well No. 7 can supply only 14 mgd to the
2 Waihe`e-Hopoi Fields, with the exception of Field 715. (Volner, Dec. 11/16/07, ¶ 3.) However,
3 HC&S's records do not indicate that Well. No. 7 was ever configured differently than its current
4 configuration (Volner, Tr. 1/30/08, p. 35, ll. 13-22). Hui/MTF FOF F-145.

5 498. HC&S estimates that it would cost approximately \$525,000 to add another booster pump
6 and additional distribution pipeline to increase the volume that can be pumped from Well No. 7
7 to HC&S's Waihe`e Ditch from 14 mgd to 28 mgd; and the cost of an additional pipeline to
8 reach Field 715 would be \$475,000. (Volner Dec. 11/16/07, ¶¶ 5, 7.) Hui/MTF FOF F-146, F-
9 147. HC&S FOF 132.

10 499. HC&S also claims that it does not have adequate electrical power to run the pumps for
11 Well No. 7 on a consistent and sustained basis because of its power contract with Maui Electric
12 Company ("MECO") and limitations of its capacity to generate electricity through its system of
13 burning bagasse and other supplemental fuels in its power plant and the operation of its hydro
14 power turbines on its ditch system which are supplied by East Maui water (Nā Wai `Ehā stream
15 waters comprise its West Maui ditch system). (Volner, WDT 9/14/07, ¶¶ 20, 20A, 20B, 20C, 22;
16 Volner, WDT 10/26/07, ¶¶ 7-10; Volner, Tr. 1/29/08, p. 184, ll. 1-25, p. 206, l. 21 to p. 207, l.
17 22; Exh. C-27; Holady, Tr. 1/31/08, p. 14, l. 23 to p. 15, l. 1.) HC&S FOF 133-139.

18 500. HC&S also claims that any increased pumping of water from the Kahului aquifer to
19 replace surface water being imported from the West Maui Ditch System would both exacerbate
20 the degree to which the sustainable yield is already being exceeded and reduce the recharge from
21 imported surface water that sustains the aquifer. (Eng, Tr. 12/14/07, p. 11, ll. 20-22, p. 47, l. 19
22 to p. 48, l. 3; Exh. C-90, p. 2; Exh. A-185, pp. 2-3; Exh. B-13; Exh. C-90.) HC&S FOF 141-143.

23 501. **Recycled County Wastewater.** Reclaimed water resources on Maui include at least five
24 mgd available from the County of Maui's Wailuku/Kahului wastewater treatment plant, which
25 currently is unused and disposed of via underground injection. (Parabicolli, Tr. 1/25/08, p. 152, ll.
26 11-18.) Several hundred thousand gallons a day of reclaimed water are also produced by private
27 treatment plants in Ma`alaea, but are also unused and disposed of. (Parabicolli, Tr. 1/25/08, p.
28 139, l. 11 to 140, l. 1.) Hui/MTF FOF E-161, E-163.

29 502. It was suggested that wastewater produced by the County of Maui could be used by
30 HC&S. However, the County currently has no existing infrastructure to deliver recycled
31 wastewater to HC&S' fields. (Parabicolli, Tr. 1/25/08, p. 159, ll. 1-14.) HC&S FOF 145

1 503. None of the parties in this case ever approached the county about any use of reclaimed
2 water. (Parabicolli, Tr. 1/25/08, pp. 144-47; p. 148, ll. 19-24.) Hui/MTF FOF E-174.

3 504. Parabicolli, the county official in charge of reclaimed water use (Parabicolli, Tr. 1/25/08,
4 p. 135, l. 8 to p. 136, l. 17), agreed that private parties could construct their own pipeline to the
5 plant. (*Id.* p. 153, l. 15 to p. 154, l. 9.) Hui/MTF FOF E-171.

6 505. **Recycled Wastewater from HC&S's Puunene Mill.** HC&S already utilizes wastewater
7 from its Puunene Mill. In 1997, HC&S developed a project to use reclaimed wastewater from the
8 Puunene mill for certain fields in Puunene and Paia via drip irrigation. The project presented
9 challenges in the form of difficulty filtering the water to the level suitable for drip irrigation; the
10 high nitrogen content of the water, which interfered with ripening of the cane; high cost of
11 maintenance and repairs; and declining yields. Due to these problems, HC&S had to convert the
12 drip irrigation system for these fields to overhead sprinklers. Fields 710, 711, 712, 713, 714 are
13 fields that are actively or were actively irrigated with the overhead sprinkler system. (Volner, Tr.,
14 1/29/08, p. 160, l. 14 to p. 161, l. 14; Exhibit E-1.) HC&S FOF 146.

15 506. **Recycled Wastewater from MLP.** Between 1995 and 1997, MLP injected their
16 wastewater into an injection well in Kahului at their cannery facility. Methane buildup in the
17 well caused an explosion. Therefore, MLP entered into an agreement with HC&S to transport
18 wastewater from their cannery facility to HC&S Fields 921 and 922, which was pasture land at
19 the time. Fields 921 and 922 are currently irrigated with Nā Wai `Ehā surface water. The
20 shutdown of the canning operation will reduce the amount of wastewater available in the future
21 by approximately one half.⁸ (Volner, Tr. 1/29/08, p. 161, l. 23 to p. 162, l. 16; Exhibit C-77;
22 Volner, Tr. 1/30/08, p. 179, ll. 16-19.) HC&S FOF 147.

23
24 **J. Economic Impact on Non-Instream Uses**

25 507. The current and potential non-instream uses include all users of diverted stream waters:
26 1) the kuleana landowners and MCLT, who seek restoration to benefit their lands; 2) MDWS,
27 who favors restoration of the Nā Wai `Ehā streams while also preserving and even expanding its
28 use of those surface waters; 3) WWC's Water Delivery Contractees; 4) even WWC, who uses non
29 water directly but is in the business of delivering stream waters to non-instream users; and 5)
30 HC&S, the major user.

⁸ None of this water source will be available. **See** footnote to FOF 261, *supra*.

1 508. No information was presented at the CCH concerning the positive economic impact on
2 kuleana landowners and MCLT, although general testimony was presented on the kinds of crops
3 and activities they would be able to engage in if they were to receive more stream waters. (See
4 FOF 294-295, *supra*).

5 509. Information on MDWS was focused on the role of stream waters as part of its integrated
6 water supply system and the benefit to its public users. (See FOF 360-373, *supra*).

7 510. Information was presented on some of WWC's Water Delivery Contractees' water uses,
8 which included the availability of MDWS water for at least some of them. (See FOF 378-416,
9 *supra*).

10 511. Some information was presented on WWC's water delivery charges, which presumably
11 would be impacted if stream diversions were to be reduced. (See FOF 378-416, *supra*).

12 512. According to a prospectus sent to shareholders on October 3, 2005, WWC stated that it
13 charges its customers "between \$0.20 and \$2.40 per thousand gallons delivered." (Exh. B-5, p.
14 3.) MDWS FOF 76.

15 513. The contracts provided by WWC indicate that most of its customers pay a rate equivalent
16 or approximate to the county rate for agricultural water, or about \$0.85 or \$0.90 per thousand
17 gallons. (See, e.g., Exh. D-90, § 1.12). Hui/MTF FOF E-44.

18 514. Many of WWC's contracts do not involve any actual present use of water, but rather
19 allow WWC to collect a minimum charge, regardless of any actual use, based on a percentage of
20 the stipulated maximum delivery. See, e.g., Exh. D-87, § 1.05; Chumbley, Tr. 1/24/08, p. 91, l.
21 13 to p. 92, l. 9.) Hui/MTF FOF E-15.

22 515. The state Public Utilities Commission ("PUC") has taken action to regulate WWC based
23 on the understanding that "WWC is and has been operating as a public utility without proper
24 authority." (Exh. C-25, p. 18.) In its February 8, 2008 application to the PUC for a Certificate of
25 Public Convenience and Necessity ("CPCN") and approval of its proposed tariff, WWC stated
26 that it has created a new utility company, Wailuku Water Distribution Company, LLC
27 ("WWDC"), of which WWC is the sole member, and from which WWC proposes to exact lease
28 payments to use the watershed land and ditch system. (Chumbley, Tr. 3/3/08, p. 117, ll. 11-18;
29 Exh. C-87, Exh. 2.) Hui/MTF FOF E-16.

1 516. WWC proposes to the PUC a tariff rate of \$0.90 per 1,000 gallons, while acknowledging
2 PUC precedent declaring preexisting rate contracts unenforceable and unlawful. (Exh. C-85, p.
3 11, ll. 1-20.) Hui/MTF FOF E-17.

4 517. WWC requested the PUC to approve a 10 percent profit rate. (Exh. C-85, p. 16, ll. 12-
5 20.) In contrast, WWC made a 14.59 and 13.85 percent profit in 2006 and 2007. (Chumbley,
6 Tr. 1/16/08, p. 58, ll. 7-16; Chumbley, WDT 9/14/07, p. 15, l. 5.) Hui/MTF FOF E-18.

7 518. WWC also receives a delivery fee for the amount taken in excess of 1.074 mgd from its
8 and MDWS's `Īao Tunnel (Well No. 5332-02). (Tr. XI, pp. 48-50; Tr. XII, pp. 88-89.) WWC
9 FOF 817. The amount of this fee was not introduced into evidence.

10 519. As previously noted, in 2004 MDWS and WWC entered into an agreement allowing
11 MDWS to receive up to 3.2 mgd from the `Īao-Waikapū Ditch. FOF 239, *supra*.

12 520. As previously noted, WWC does not charge the kuleana users for deliveries. FOF 160,
13 *supra*. HC&S pays WWC a flat fee per acre for water used on the `Īao-Waikapū Fields,
14 regardless of how much water is used; in 2005 that fee was \$300/acre/year. (Tr. 1/30/08
15 (Volner), p. 26, ll. 3-7; Exh. D-56, p. 4; Chumbley, Tr. 1/24/07, p. 41, ll. 3-18.) Hui/MTF FOF F-
16 10.

17 521. The focus at the CCH on the economic impact on non-instream uses was on HC&S.

18 522. HC&S has concluded that, in addition to the technical issues associated with pumping a
19 substantial amount of water from Well No. 7 to replace ditch waters, it would: 1) incur estimated
20 costs of \$1 million to install new pipelines and pumps (Volner, WDT 9/14/07, ¶¶ 6-7; Volner,
21 WDT 11/16/07, ¶¶ 3,5; Volner, Tr. 1/29/08, p. 176, ll. 19-25, p. 177, ll. 3-25) HC&S FOF 132; 2)
22 incur costs of \$777,650, in addition to the \$1 million, because MECO would require upgrades to
23 its pumps and related electrical equipment to MECO's standards for servicing such equipment
24 (Volner, WDT 11/16/07, ¶ 7; Exh. E-21) HC&S FOF 139; 3) cost an additional \$310 per MWH,
25 or \$7,440 per day, to run Well No. 7 (Volner, WDT 11/16/07, ¶ 9) HC&S FOF 139) and 4) lose
26 \$1.8 million in annual revenues under its contract with MECO as well as a decrease in HC&S's
27 avoided cost rate and penalties three times the power rate for power it does not deliver (Holaday,
28 Tr. 1/31/08, p. 15, l. 10 to p. 16, l. 19). HC&S FOF 134.

29 523. A key factor in HC&S' ability to sustain itself is the economies of scale it can apply to
30 the approximately 35,000 contiguous acres it cultivates on Maui, of which the West Maui Fields
31 comprise about 5,300 acres. (Holaday WDT 9/14/07, pp. 2-3; Volner, Tr. 1/30/08, p. 200, Exh.

1 E-28). WWC FOF 197-198.

2 524. The West Maui Fields provide the most productive yields of all of HC&S's cultivated
3 lands, making the West Maui Fields critical to the viability of HC&S. (Holaday, WDT 9/14/07,
4 pp. 2-3; Holaday, Tr. 1/31/08, p. 65; Volner, Tr. 1/30/08, p. 200.) WWC FOF 199.

5 525. In 2006, HC&S grew 81 percent of Hawai'i's raw cane sugar crop. (Holaday, WDT
6 9/14/07, p. 2.) WWC FOF 200..

7 526. HC&S employs about 800 full-time workers and EMI employs about 17 workers on
8 Maui. (Holaday WDT 9/14/07, p. 5; Holaday, Tr. 1/31/08, p. 11; Hew, Tr 1/29/08, pp. 9, 165-
9 168; Exh. E-28.) WWC FOF 202.

10 527. HC&S forecast that it generates approximately \$250,000,000 annually to the County of
11 Maui and State of Hawai'i economies (using a multiplier of 2.5 to the \$100,000,000 plus HC&S
12 expenditure on Maui each year). (Holaday WDT 9/14/07, p. 5.) WWC FOF 203.

13 528. HC&S' sustainability is to some extent a result of its ability to spread its fixed costs of
14 mill and related facilities operations over the revenues generated from farming the extensive
15 acreage. (Holaday WDT 9/14/07, p. 2; Holaday, Tr. 1/31/08, p. 13; Holaday, Tr. 1/30/08, pp.
16 201-202.) WWC FOF 204.

17 529. One method of spreading costs is to generate revenues from the by-products of farming
18 sugar cane and production of raw sugar. (Holaday, WDT 9/14/07, pp. 2-7.) WWC FOF 205.

19 530. One revenue source, energy sales, comes from the burning of bagasse, a by-product of
20 sugar cane production, and from hydro power, a by-product of operation of a water delivery
21 system. (Holaday, WDT 9/14/07, p. 2-3.) HC&S's business success depends on its ability to
22 receive significant revenues from selling the electric power it generates to Maui Electric
23 Company under long term contracts. (Holaday WDT 9/14/07, pp. 2 - 3; Holaday, Tr. 1/31/08, pp.
24 13-20; Holaday, Tr. 1/30/08, pp. 190, 200-201.) Revenues from energy sales make up about 20
25 percent of the total revenues generated by the agribusiness companies compared to about 5
26 percent of the total revenues from a decade before. (Holaday, WDT 9/14/07, pp. 2 - 3; Holaday,
27 Tr. 1/31/08, pp. 19-20, 140-142; Holaday, Tr. 1/30/08, p. 201.) WWC FOF 206-208.

28 531. HC&S diversified its product line by increasing production of foodgrade raw sugar,
29 which returns a higher margin than commodity sugar. (Holaday WDT 9/14/07, pp. 3-4; Holaday,
30 Tr. 1/31/08, pp. 12-13, 19-20.) WWC FOF 211.

31 532. In the last four years, HC&S made capital investments of up to \$20,000,000 supporting

1 its efforts to diversify product lines, reduce costs of production, and increase revenues from other
2 sources. (Holaday, WDT 9/14/07, p. 4; Holaday, Tr. 1/31/08, pp. 19-21.) WWC FOF 212.

3 533. HC&S states that, if reductions in HC&S' use of Nā Wai 'Ehā stream water were of such
4 a magnitude as to force HC&S not to cultivate the 5,300 acres that comprise the West Maui
5 fields, HC&S would not be a viable plantation. (Volner, Tr., 1/30/08, p. 200, ll. 17-21; Holaday,
6 Tr. 1/31/08, p. 143, ll. 9-14.) In addition to the immediate impacts in terms of lost jobs and in
7 excess of \$100,000,000 of spending on Maui, closure of HC&S will have a deleterious effect on
8 efforts to promote agriculture and curb urbanization in Hawai'i. The withdrawal of HC&S'
9 35,000 acres of prime agricultural lands from sugar would vastly increase the agricultural lands
10 in the State of Hawai'i and on Maui that are idle. Past experience with closure of other
11 plantations has demonstrated the difficulty of returning former plantation lands into agriculture,
12 especially if reliable access to irrigation water is curtailed. This increases the pressure to
13 urbanize these lands instead of keeping them in agricultural use. (Holaday, WDT 9/14/07, ¶ 18;
14 Kennison, Tr. 1/25/08, p. 55, l. 19 to p. 56, l. 6.) Idling of HC&S' lands will also result in the
15 deterioration of existing irrigation systems and infrastructure that would be extremely expensive
16 to replace. (Holaday, WDT 9/14/07, ¶ 18.) HC&S FOF 123-124.

17 534. Generally, remaining economically viable involves achieving targets in terms of sugar
18 yields and maintaining a reasonable cost structure. Small reductions of water for irrigation on
19 any given day might have little or no negative impact, depending on weather conditions,
20 location, and crop cycle. Larger, persistent reductions, with no corresponding mitigation of
21 impacts, especially if combined with reductions in the amounts that HC&S will be permitted to
22 continue to divert in East Maui, will likely render HC&S unviable. (Holaday, WDT 10/26/07, ¶
23 4.) HC&S FOF 126.

24 535. The key agronomic driver in determining sugar production is per acre yields, which is
25 measured in tons of sugar per acre ("TSA"). HC&S has determined that, on a long term basis,
26 sustainable yields should be between 13 and 14 TSA per crop cycle, which would translate into
27 over 200,000 tons of sugar per year given the acreage that HC&S has in cultivation. HC&S
28 needs to achieve yields in this range to remain viable, i.e., to generate sufficient revenues to carry
29 its fixed and variable costs and return a reasonable profit to its shareholders. One of the most
30 important variables determining yields is water. (Holaday, WDT 9/14/07, ¶ 12; Holaday, Tr.
31 2/22/08, p. 116, ll. 15-21.) As a rule of thumb, HC&S needs to harvest about 400,000 acre-

1 months of cane growth per year to be viable. That translates into approximately 200,000 tons of
2 sugar. (Holaday, Tr. 1/31/08, p. 44, l. 22 to p. 45, l. 3.) Reduction of water deliveries to Waiale
3 Reservoir, especially during periods of low ditch flows, will force HC&S to try to replace that
4 water to the extent possible by pumping water from Well No. 7 at the expense of pumping from
5 other wells. However, power limitations restrict the amount of water that HC&S can ultimately
6 pump, which affects sugar yields. (Holaday, WDT 9/14/07, ¶ 13.) HC&S FOF 127.

7 536. Prolonged drought conditions, such as HC&S has experienced for much of the last 15
8 years, can cause a reduction in average crop age by delaying the replanting of harvested fields
9 and prompting the premature harvesting of fields whose growth potential is compromised by
10 lack of water. Disease and other operating conditions can also cause a reduction in average crop
11 age. In addition, during water-short periods, the cane does not grow; hence the physical age of
12 the cane is greater than the growth age. (Holaday, WDT 11/16/07, ¶ 7.) HC&S FOF 128.

13 537. The average crop age of harvested acres at HC&S has dropped from 2003 to 2006 due to
14 the combined effects of drought and HC&S's 2001 closure of its Paia Mill, which was done to
15 reduce costs and increase efficiency by centralizing all sugar processing at the Puunene Mill. In
16 2001, total acres harvested were approximately 2000 less than the prior year, because the
17 Puunene Mill was initially unable to absorb all of the lost capacity from the Paia Mill closure.
18 Harvesting fewer acres increased the average crop age of the unharvested acres. As capacity was
19 added to the Puunene Mill and HC&S gained more experience in the reconfigured operation,
20 harvested acres increased again, resulting in a lower average crop age and lower yields.
21 (Holaday, WDT 11/16/07, ¶ 7.) HC&S FOF 129.

22 538. Given the currently reduced crop age of HC&S' fields, HC&S expects to reduce its rate
23 of harvesting into 2008 and 2009 to allow for an increase in crop age so as to improve yields, and
24 then return to harvesting at its historic rate of approximately 16,000 to 17,000 acres per year that
25 maximizes the acreage that can be served with currently available irrigation water as well as the
26 current processing capacity of the Puunene Mill. The short-term result will be diminished
27 revenues both from reduced sugar production and reduced production of bagasse to fuel the
28 power plant. The hoped for longer term result will be increased yields which, together with
29 increased revenues from the production and sale of specialty sugars and further expansion of
30 energy related sales, will allow HC&S to remain economically viable. This will only be possible,

1 however, if HC&S's continued access to irrigation water is not unduly compromised. (Holaday,
2 WDT 11/16/07, ¶ 11.) HC&S FOF 130.

3 539. Chan-Halbrendt, OHA's expert witness, determined that HC&S "provided no economic
4 analysis of the impacts of decreasing its use of Nā Wai `Ehā water," and "made no apparent
5 attempt to substantiate and quantify the impact, even though I believe many of the essential data
6 for such analysis are within HC&S's possession." (Exh. C-46, p. 1.) Hui/MTF FOF F-188.

7 540. Referring to Alexander & Baldwin's ("A&B") form 10-K filings (Exh. C-47) Chan-
8 Halbrendt remarked that, "looking at this data, it makes you also wonder how they could make
9 these statements." (Chan-Halbrendt, Tr. 2/22/08, p. 65, ll. 11-17.) She cited the following
10 examples:

11 a. HC&S claimed that, in order to remain economically viable, it needed
12 to achieve a yield of 13 to 14 tons of sugar per acre ("TSA") on a
13 sustainable, long-term basis. (Holaday, Dec. 9/14/07, ¶ 12.) The data
14 from A&B's 10-K filings indicate that HC&S had obtained those
15 yields in only four of the fifteen years from 1992 to 2006, and that
16 there was only a weak correlation, if any, between the TSA and
17 HC&S's profits. (Exh. C-46, p. 3; Exh. C-47; Chan-Halbrendt, Tr.
18 2/22/08, p. 65, l. 18 to p. 66, l. 5.)

19 b. HC&S claimed that it had "benefitted" from the acreage it leased in
20 the `Īao-Waikapū Fields and the additional Nā Wai `Ehā water it
21 gained access to when WWC's predecessor abandoned sugar
22 cultivation. (Holaday, Dec. 9/14/07, ¶ 8.) The data from A&B's 10-K
23 filings indicates that HC&S's raw sugar production was lower in the
24 ten years after 1994, when it leased the additional acreage in the `Īao-
25 Waikapū Fields, than it was in the ten years before, and the
26 profitability of the agribusiness sector, of which HC&S is a part,
27 actually decreased after 1988, when HC&S gained access to the
28 additional Nā Wai `Ehā stream water. (Exh. C-46, p. 3; Exh. C-47;
29 Chan-Halbrendt, Tr. 2/22/08, p. 66, l. 6 to p. 67, l. 1.)

30 c. HC&S claimed that maintaining the number of acres it has in sugar
31 cultivation is necessary to remain economically viable (Holaday, Dec.

1 9/14/07, ¶ 6; see also Holaday, Tr. 1/31/08, p. 54, ll. 2-5.) A&B’s 10-
2 K filings, though, indicate that, from 2000 through 2005, HC&S
3 decreased its cultivated acreage by more than 2000 acres, which
4 increased only slightly in 2006. (Exh. C-47; Exh. C-46, p. 4.)
5 Moreover, A&B has development plans that would remove almost
6 3,500 additional acres from cultivation. (Exhs. A-204 to A-209.)

7 Chan-Halbrendt concluded that the discrepancy between HC&S’s broad conclusions about
8 economic impact and the limited available data highlights the need for economic analysis, rather
9 than unsubstantiated assumptions, to support reasoned decision-making. (Exh. C-46, p. 2.)
10 Hui/MTF FOF F-189.

11 541. HC&S has also claimed that its survival hinges on the `Āao-Waikapū Fields and having
12 sufficient Nā Wai `Ehā water to irrigate them (Holaday, Dec. 10/26/07, ¶ 7), but it made no
13 apparent attempt to acquire those lands when they became available (Volner, Tr. 1/30/08, p. 186,
14 l. 17 to p. 187, l. 3). HC&S had no written agreement with WWC after July 2003, when WWC
15 refused to extend the land lease and announced HC&S was “no longer entitled to any water
16 allocation pursuant to that Temporary Water Agreement.” (Exh. A-212, pp. 1-2; Chumbley, Tr.
17 3/3/08, p. 96, l. 9 to p. 97, l. 17.) This continued until July 2005 (after the IIFS petition was
18 filed), when Atherton et al. began acquiring the land and HC&S and WWC settled on their
19 present terms for water in a one-page letter. (Exh. D-56, p. 4.) Hui/MTF FOF F-190.

20 542. To assess whether reducing the Nā Wai `Ehā water available to HC&S on 15 percent of
21 its cultivated acreage would have impacts that extend to the economies of the County of Maui
22 and the State of Hawai`i would require, initially, a partial equilibrium analysis to determine the
23 impacts on HC&S, which would then feed into a general equilibrium analysis which would
24 consider inter-sectoral, employment, and income impacts and may include the economic values
25 and opportunity costs of alternative uses of water, including instream uses. (Exh. C-46, pp. 1-2;
26 Chan-Halbrendt, Tr. 2/22/08, p. 67, l. 21 to p. 68, l. 8.) Such an analysis, had HC&S performed
27 one, may potentially have revealed “not only a mitigation of adverse impact, but also an overall
28 increase in economic and social welfare” because, among other things, “reallocation of water can
29 facilitate its efficient and equitable distribution to higher valued uses, both within agriculture as
30 well as in other sectors.” (Exh. C-46, pp. 4-5; see also Chan-Halbrendt, Tr. 2/22/08, p. 67, ll. 4-
31 17; p. 68, ll. 9-17.) Hui/MTF FOF F-191.

1 543. Chan-Halbrendt, commenting on HC&S's description of the impacts of shutting down its
2 sugar operations entirely, concluded that "the relevant issue requiring analysis is the economic
3 impact of decreasing the supply, or increasing the cost, of water to approximately 15 percent of
4 HC&S's fields. Absent that analysis, there is no reason to suppose that cessation of all sugar
5 cultivation would be an economically rational response." (Exh. C-46, p. 4.) Hui/MTF FOF F-192.

6 544. A&B's practice is to shut down an operating company if the losses incurred in operating
7 the company are greater than the costs of not operating the company. Consistent with its past
8 practice, Holaday believes that A&B would shut HC&S down if and when the operating costs of
9 HC&S exceeded the holding costs that would be incurred in shutting the company down, such as
10 real property taxes, insurance, security, and other holding costs, "things like that that you project
11 what those costs are," as well as the social costs. (Holaday, Tr. 1/31/08, p. 115, l. 10 to p. 116, l.
12 24.) Hui/MTF FOF F-193.

13 545. Chan-Halbrendt commented that one such cost would be significantly increased real
14 property taxes; for example, in 2007, the County of Maui assessed the value of HC&S's
15 agricultural lands in TMKs (2) 3-8-5-3, (2) 3-8-5-2, (2) 3-8-6-3, and (2) 3-8-5-23 alone (those
16 TMKs comprise the Waihe'e-Hopoi Fields and Field 920), at \$60,892,600, but, because the land
17 was in agriculture, HC&S paid real property taxes on a net taxable land value of only
18 \$2,388,400.00 for those TMKs, less than five percent of the total assessed land value. (Exhs. C-
19 52A – C-52D.) Almost twenty years ago, the state Department of Business and Economic
20 Development recognized that one of the incentives for a sugar company to continue operations
21 despite lack of profitability was "banking land for future development while continuing to pay
22 low property taxes afforded by the favorable tax assessments on agricultural land (i.e., profits are
23 made instead on the annual appreciation of the land)." (Exh. C-46, p. 7.) Hui/MTF FOF F-194.

24 546. HC&S had not "done any economic analysis on how a reduction of available surface
25 water in this case would force HC&S to shut down"; Mr. Holiday "[could not] say yes or no"
26 when asked whether shifting 9 mgd of Nā Wai `Ehā surface water to another purpose would
27 prevent HC&S from being viable, but testified that HC&S is "assuming" that impact "for
28 planning purposes." (Holaday, Tr. 1/31/08, p. 114, l. 10 to p. 115, l. 15; p. 78, l. 25 to p. 79, l.
29 13.) Hui/MTF FOF F-195.

30 547. Chan-Halbrendt concluded that an assessment of the economic effect, if any, of
31 incremental reductions of available Nā Wai `Ehā water could be done through a partial

1 equilibrium analysis, which could be very simple and would rely on data that HC&S should have
2 available; it is the type of analysis HC&S claims that it routinely employs for planning purposes,
3 although it did not in this case. (Exh. C-46, p. 1; Chan-Halbrendt, Tr. 2/22/08, p.106, l. 20 to p.
4 107, l. 6; Holaday, Tr. 2/22/08, p. 110, l. 16 to p. 111. l. 13.) Hui/MTF FOF F-198.

5 548. A partial equilibrium analysis could examine the impact on HC&S's profitability under
6 several scenarios, such as: use of pumped ground water or conservation measures to compensate
7 for incremental reductions of Nā Wai `Ehā water; projected change in yield caused by varying
8 increments of water reduction; incremental shifts in cultivated acreage in response to incremental
9 reduction in available water; or a combination of such factors. (Exh. C-46, p. 1.) Hui/MTF FOF
10 F-199.

11 549. Chan-Halbrendt stated that the scenarios identified for analysis in a partial equilibrium
12 analysis are substantially the same as those identified by HC&S as available options in the event
13 its access to Nā Wai `Ehā is restricted. HC&S's estimate of electrical costs of pumping Well No.
14 7, without any information about the costs or benefits of the other options, might be a factor in an
15 economic analysis, but does not substitute for the analysis. (Chan-Halbrendt, Tr. 2/22/08, p. 88, l.
16 25 to p. 90, l. 3.) HC&S has not analyzed the economic impact of increased water costs on its
17 business (Holaday, Tr. 1/31/08, p. 80, l. 23 to p. 81, l. 2) and has done no financial analysis of
18 the impact of having to pay for water at the agricultural rate that other farmers pay (Holaday, Tr.
19 1/31/08, p. 131, ll. 16-20; p. 132, ll. 10-21). Hui/MTF FOF F-200, F-201, F-202.

20 550. Chan-Halbrendt was asked to evaluate the economic analysis undertaken by HC&S, not
21 perform an independent economic analysis of the impact of stream water reductions to HC&S.
22 (Chan-Halbrendt, Tr. 2/22/08, p. 65, ll. 5-10, p. 76, ll. 17-23.) HC&S FOF 156.

23 551. According to Chan-Halbrendt, "the lack of any economic analysis, or the data required to
24 conduct such an analysis, prevents anyone, including this Commission, from evaluating HC&S's
25 claims of economic impact." (Exhibit C-46, p. 1) By economic analysis, Chan-Halbrendt refers
26 to an appropriate tool or framework to study economic performance under certain conditions.
27 (Chan-Halbrendt, Tr., 2/22/08, p. 60, ll. 2-8.) Specifically, she advises conducting a general
28 equilibrium analysis and partial equilibrium analysis. General equilibrium analysis analyzes how
29 an industry affects other sectors' economy, while partial equilibrium analysis analyzes the
30 impact of changes on economic performance on the industry itself. (Chan-Halbrendt, Tr. 2/22/08,
31 p. 60, l. 22 to p. 61, l. 2.) HC&S FOF 157.

1 552. Chan-Halbrendt did not review Volner's testimony or the testimony and evidence
2 received at the hearings, which would contain information relevant to an economic analysis.
3 (Chan-Halbrendt, Tr. 2/22/08, p. 85, l. 13 to p. 87, l. 8, p. 89, ll. 8-15.)

4 553. Chan-Halbrendt also criticized HC&S's claim that it needs to produce 13-14 TSA per
5 crop cycle to remain economically viable. She noted that A&B's Form 10-K filings show that
6 since the 1980's, HC&S has achieved the yield of 13-14 TSA only four out of 15 years, and yet,
7 in that period, HC&S failed to make a profit only three out of five years. (Chan-Halbrendt, Tr.
8 2/22/08, p. 65, l. 11 to p. 66, l. 5; Exhibit C-46, p. 3.) In addition, she opined that the Form 10-K
9 filings do not support HC&S's claim that its operations benefited from leasing additional acreage
10 and receiving additional water from WWC after the closure of Wailuku Sugar Co., because the
11 filings show that production was higher on average before HC&S leased the additional land than
12 afterwards. (Chan-Halbrendt., Tr.,2/22/08, p. 66, l. 9 to p. 67, l. 1; Exhibit C-46 at 3-4.) HC&S
13 FOF 159.

14 554. HC&S's response is that financial information about the A&B Agribusiness Group
15 reported in the Form 10-K filings is meant only to provide a general view of the performance of
16 the group. The filings do not account for revenues not based directly on sugar production, such
17 as power sales to MECO. The filings also do not account for increased costs, declines in sugar
18 prices, the effects of disease and drought, the effects of federal disaster relief payments received
19 by HC&S for drought conditions, the inclusion of C&H in the financial reports of the
20 Agribusiness Group from 1993 through 1998, the addition of specialty sugars sales in later years,
21 and other factors that influence the profitability of HC&S. (Holaday, WDT 11/16/07, ¶ 4.)
22 Holaday testified that given HC&S' cost structure, which in 2008 totaled approximately \$104
23 million, HC&S needs to generate revenue based on 13-14 TSA to remain viable going forward.
24 (Holaday, Tr. 2/22/08, p. 109, l. 13 to p. 110, l. 9, p. 112, ll. 14-15.) HC&S FOF 160.

25 555. Second, Chan-Halbrendt did not focus on crop age and acres harvested. There is a very
26 high correlation between average crop age per acre harvested and TSA. All other things being
27 equal, the greater the age of the cane at the time of harvest, the greater the yield and the resulting
28 sugar revenues over which to spread the average cost of preparing, planting, and harvesting each
29 acre during a given two-year cycle as well as the fixed costs of operating and maintaining
30 HC&S' mill and other facilities. All other things being equal, producing more sugar per acre
31 harvested in turn results in more net sugar revenues, and harvesting more acres results in the

1 production and sale of more sugar. (Holaday, WDT 11/16/07, ¶¶ 5, 6, 10; Holaday, Tr. 2/22/08,
2 p. 118, l. 21 to p. 119, l. 17; Exh. E-22.) HC&S FOF 161.

3

4 **K. Interim Instream Flow Standards (“IIFS”)**

5 556. Benbow, Hui/MTF’s expert witness, concluded that “(p)ending firmer scientific
6 information from further studies, flow restoration should uphold two guiding principles. First,
7 the flow amounts must create enough quality habitat to support sustainable, reproductive
8 instream biological communities, taking into account public uses such as Native Hawaiian
9 gathering practices. Second, the flow amounts must maintain enough continuous flow from
10 mauka to makai to enable the streams to serve their natural ecological functions, including
11 sustaining the life cycles of the native amphidromous species. (Benbow, Tr. 12/10/07, p. 22, ll.
12 7-21; Benbow, WDT 9/14/07, ¶ 22.) Hui/MTF FOF C-48.

13 557. Ford, HC&S’s expert witness, disagreed that continuous flow from mauka to makai is
14 necessary to enable the streams to serve their natural ecological functions and distinguishes
15 between physical connectivity versus ecological connectivity (stream flows of sufficient volume
16 and frequency to allow the normal distribution of native amphidromous species within a given
17 watershed). (Ford, Tr. 12/10/07, p. 219, l. 24 to p. 221, l. 7; Exh. E-53, p. 41, § 1.0 and p. 43, §
18 8.0.) HC&S FOF 50.

19 558. The diversion structures consisting of grates spanning the entire stream channel are
20 potentially the worst possible configuration from a biological perspective because they sever the
21 mauka to makai flow continuum and impose a physical barrier and trap, preventing passage of
22 native amphidromous stream life between upstream habitats and the ocean. (Benbow, WDT
23 9/14/07, ¶ 16; Payne, Tr. 12/12/07, p. 103, ll. 1-22.) Hui/MTF FOF C-28.

24 559. HC&S’s consultants expressed the desire to explore ways that might lead to improved
25 migration over the dam. There would be various mechanisms available to provide water, and
26 these particular structures could be modified in some ways to provide a flow, including blocking
27 off some of the grated areas. (Ford, Tr. 12/11/07, p. 131, l. 16 to p. 132, p. 23; Payne, Tr.
28 12/12/07, p. 104, ll. 4-16.) Hui/MTF FOF C-67.

29 560. Particularly in Waihe’e River and `Īao Stream, the diversions take almost all (more than
30 90 percent and sometimes up to 100 percent) of their total low flows, leaving stream beds dry for
31 extended lengths and without connection to the ocean. Habitat above the diversions is

1 characterized by high flow, numerous riffles, and cascades, while habitat below the diversions,
2 where existing at all, is characterized by low flow, infrequent riffles, and small shallow pools.
3 (Benbow, WDT 9/14/07, ¶ 15.) Hui/MTF FOF C-26.

4 561. Benbow, Hui/MTF's expert witness, has conducted multi-year studies of Central Maui
5 streams and found that the largest migrations of native stream species occur in streams with
6 minimal or no diversions, and the greatest reductions in recruitment during drought occur in
7 diverted streams such as Waihe'e River. (Benbow, WDT 9/14/07, ¶¶ 11, 36.) Hui/MTF FOF C-
8 16.

9 562. SWCA Environmental Consultants ("SWCA") was retained by HC&S to evaluate
10 amphidromous species in the four Nā Wai 'Ehā streams, conducting the studies in 2007 and early
11 2008. A series of larval drift sampling was also performed in Waihe'e Stream, Waiehu Stream,
12 and Waikapū Stream, and in ditch discharges diverted from 'Īao Stream. Larval drift sampling
13 was conducted to evaluate whether amphidromous species are reproducing within the Nā Wai
14 'Ehā streams. The larval drift sampling employed methods developed by Lindstrom (1998a,b).
15 (Exhibit E-53 at 22 (§ 6.4).) HC&S FOF 51.

16 563. SWCA described its findings in Waihe'e River as normal patterns of migration, species
17 and size distribution, and reproduction throughout the stream under diverted conditions, with its
18 larval drift sampling indicating that Waihe'e River is the only stream that appears to have
19 significant reproductive populations of native amphidromous species. (Exh. E-53, p. 44, § 9.0.)
20 HC&S FOF 53.

21 564. SWCA observed low numbers of adult amphidromous species in Waiehu Stream. No
22 larvae were found in the downstream drift samples collected from the stream. Waiehu Stream
23 does not appear to have significant reproductive populations of these species. However, there is
24 evidence of ecological activity in Waiehu Stream because at least two species of 'o'opu and
25 amphidromous prawns were found in the upper reaches of that stream, and recruits were found
26 on the mauka side of the culverts under Kahekili Highway. (Ford, Tr. 10/18/08, p. 226, ll. 5-14.)
27 HC&S FOF 59.

28 565. Only a few large adult 'o'opu alamo'o, 'o'opu nōpili, and 'o'opu nākea were observed by
29 SWCA within 'Īao Stream, and no juvenile or post-larval recruits were found in the stream above
30 the channelized section. (Exh. E-53, p. 4, § 8.0.) Benbow testified that both he and DAR
31 biologist Skippy Hau have artificially planted 'o'opu and hihiwai post-larvae above the

1 diversions in 'Īao Stream. (Benbow, Tr. 12/10/07, p. 114, ll. 16-23.) It is likely that the 'o'opu
2 observed by SWCA in 'Īao Stream were those introduced by Hau and/or Benbow. The endemic
3 shrimp *Atyoida bisulcata* ('opae kala'ole) was highly abundant, although it is unknown whether
4 they are maintained by recruitment from the sea up to the 'Īao channel, or from populations of
5 shrimp within the Waihe'e and Spreckels Ditches. (Exh. E-53, p. 4, § 8.0.) No larval fishes or
6 crustaceans were represented in the drift samples collected from 'Īao Stream. (Exh. E-53, p. 43, §
7 8.0.) HC&S FOF 61-62.

8 566. The only amphidromous species observed in Waikapū Stream in the SWCA study was
9 'opae kala'ole, and only large adults were found. No recruitment of post-larval 'opae into the
10 stream or reproduction (as indicated by the larval drift samples) was observed in the studies.
11 Some 'opae were found, but these may have been planted or entered via the ditches rather than
12 recruiting naturally from the ocean. (Exh. E-53, p. 44, §§ 8.0, 9.0.) HC&S FOF 64.

13 567. It is conceivable that the 'opae are moving from stream to stream, because in order for
14 them to recruit into Waikapū Stream naturally, they would have to come up via Kealia Pond.
15 However, Waikapū Stream does not have physical connectivity to the sea through Kealia Pond
16 except during prolonged intense flooding events. (Ford, Tr. 12/10/07, p. 225, l. 6 to p. 226, l. 3;
17 Exh. E-53, p. 44, § 9.0.) When there is flow from Waikapū Stream to Kealia Pond, the water
18 does not travel via a continuous channel through the pond and into the ocean, but instead, fans
19 out into a big delta. (Ford, Tr. 12/10/07, p. 241, l. 15 to p. 242, l. 15.) HC&S FOF 65.

20 568. On the basis of these findings, SWCA concluded that what it calls "ecological
21 connectivity" exists under diverted conditions in Waihe'e River and Waiehu Stream. Although
22 adult 'opae kala'ole were found in upper 'Īao and Waikapū Streams, SWCA believes these may
23 have been introduced to the stream by DAR biologists. SWCA did not find larval, post-larval, or
24 juvenile amphidromous species in either 'Īao or Waikapū streams. (Exhibit E-53 at 4 (§ 1.0).)
25 HC&S FOF 52.

26 569. However, based on the field work up to December 2007, SWCA was not "able to come to
27 any conclusion regarding the number of animals there." (Ford, Tr. 12/11/07, p. 83, ll. 12-21.)
28 Hui/MTF FOF C-84.

29 570. Moreover, SWCA's larval drift survey lasted one week in total, including one day each in
30 Waiehu and Waikapū Streams and the Spreckels Ditch diversion of 'Īao Stream. (Exh. E-53, pp.

1 41-42.) In contrast, other previous studies spanned an entire year or multiple years. (Ford, Tr.
2 10/14/08, p. 178, ll. 4-10.) Hui/MTF FOF C-87a.

3 571. SWCA initially intended to sample larval drift at different locations in the stream, not just
4 at the mouth (Ford, Tr. 12/11/07, p. 107, l. 22 to p. 108, l. 6), and other studies sampled at
5 multiple locations (Ford, Tr. 10/14/08, p. 177, l. 13 to p. 178, l. 3). SWCA sampled only at one
6 point below the diversions for each stream. (Tr. 10/14/08, p. 21, l. 5 to p. 22, l. 17.) Hui/MTF
7 FOF C-87b.

8 572. SWCA did not measure the sample volumes and calculate larval densities, which is the
9 “established methodology” in the previous studies (Ford, Tr. 10/14/08, p. 178, l. 22 to p. 279, l.
10 15), so it is unknown how the samples compared more broadly. (Lindstrom, Tr. 10/14/08, p. 33,
11 l. 13 to p. 34, l. 8.) Hui/MTF FOF 87d.

12 573. SWCA’s larval drift survey was “just a snapshot” that did not allow “broad
13 extrapolations over time” or “to other streams.” (Lindstrom, Tr. 10/14/08, p. 55, ll. 11-21.)
14 Hui/MTF FOF C-88.

15 574. Given these limitations, the larval drift survey could only observe that there was
16 “something” in Waihe`e River and nothing in the other streams at that particular time.
17 (Lindstrom, Tr. 10/14/08, p. 33, ll. 3-17.) It is unknown whether Waihe`e River hit a “larval
18 jackpot,” or if the other streams had a larval “bust” on the day of sampling. (Id. p. 27, ll. 18-21;
19 p. 28, ll. 15-19.) Hui/MTF FOF C-89.

20 575. No study has correlated larval drift with upstream abundance. (Ford, Tr. 10/14/08, p. 182,
21 l. 2 to p. 183, l. 20.) Given that o`opu can lay tens or hundreds of thousands or even over a
22 million at a time, it is unknown how many animals contributed to SWCA’s sampled larvae.
23 (Lindstrom, Tr. 10/14/08, p. 35, l. 8 to p. 36, l. 5.) Hui/MTF FOF C-91

24 576. Lindstrom, HC&S’s expert witness, agreed that it would be “fairly essential” to compare
25 larval densities between Waihe`e River and another relatively undiverted or naturally flowing
26 stream before making any kind of conclusions about the quality or normality of Waihe`e River’s
27 reproductive output. (Lindstrom, Tr. 10/14/08, p. 34, ll. 9-20.) Hui/MTF FOF C-94.

28 577. Benbow, Hui/MTF’s expert witness, concluded that, “(s)hort of restoration of 100 percent
29 of natural flows, the working presumption should be that the streams of Nā Wai `Ehā need no
30 less than 75 percent of annual median flow to maintain their overall biological and ecological
31 integrity over the short and long term.” (Benbow, WDT 9/14/07, ¶ 24.) Hui/MTF FOF C-53.

1 578. Benbow uses the median to measure total streamflow (Tr. 12/10/07, p. 23, ll. 13-15),
2 which is the “preferred measure of typical flow conditions” instead of mean (or “average”) flow
3 (Exh. A-7, pp. 12-13). The median is synonymous with Q_{50} , or the flow equaled or exceeded 50
4 percent of the time. (Oki, WDT 9/14/07, ¶ 21; Payne, Tr. 12/11/07, p. 249, ll. 20-21.) Hui/MTF
5 FOF C-50.

6 579. Benbow’s recommendation of releases of 75 percent of the annual Q_{50} of the Nā Wai
7 ‘Ehā streams computes to flow values approximately between the Q_{65} and Q_{85} of the streams.
8 These duration values mean that 15 to 35 percent of the time streamflows will be naturally lower
9 even without any diversions. (Payne, WDT, at ¶ 11; Payne, Tr. 12/11/07, p. 251, ll. 20-24.)
10 HC&S FOF 35A.

11 580. Benbow’s recommendation nearly matches the Q_{70} level, or what USGS theorizes is the
12 mean base flow component of total flow; however, Benbow stated that he did not rely on that
13 fact for his recommendation. (Benbow, Tr. 12/10/07, p. 174, ll. 7-13.) Hui/MTF FOF C-51.

14 581. Benbow states that “(t)he 75 percent of median recommendation is less than optimal, but
15 incorporates a margin of safety to compensate for natural or other variations in streamflow
16 (Benbow, Ph.D. WDT 9/14/07, ¶ 27), which may include long-term drought if a moving median
17 is adopted (Tr. 12/10/07 (Dr. Benbow), p. 23, l. 22 to p. 24, l. 2). The margin of safety accounts
18 also for the absence of more detailed scientific information on the necessary flow amounts.
19 (Benbow, Ph.D. WDT 9/14/07, ¶ 27.) Lesser amounts would foreclose benefits to stream life
20 and ecology and the opportunity for the necessary studies to determine whether our best
21 estimates of the minimum flows should be maintained or modified.” (Id.) Hui/MTF FOF C-56.

22 582. When asked to clarify how “annual median flow” would be calculated, Benbow stated
23 that a “starting place” would be the historical median flow for the period between 1984 to 2005.
24 (Benbow, Tr. 12/10/07, p. 38, l. 25 to p. 39, l. 12.) However, Benbow proposed that the 75
25 percent figure be adjusted periodically. For example, every six months, the median flow for the
26 previous year would be calculated, and 75 percent of that flow would be released. (Benbow, Tr.,
27 12/10/07, at 133:23 to 134:14)

28 583. The 75 percent figure is supposed to represent a “null hypothesis.” (Benbow, Tr.
29 12/10/07, p. 30, l. 24 to p. 31, l. 3.) However, Payne, HC&S’s expert witness, stated that varying
30 the 75 percent figure every six months would defeat the purpose of testing if a control flow has

1 any effect on the stream. It would be impossible to isolate test variables if the control flow were
2 adjusted over the test period. (Payne, Tr. 12/12/07, p. 24, l. 17 to p. 25, l. 24.) HC&S FOF 35C.
3 584. Payne testified that the technique of using flow duration curves to derive instream flow
4 recommendations is well established in the scientific literature. The Tennant Method (Tennant
5 1976), has as a basis various percentages of the mean annual flow. The New England Base Flow
6 Method (Larsen 1981) uses the median August flow to set a minimum flow value. Many others
7 (e.g. Hoppe Method, Northern Great Plains Resource Program Method, Lyon's Method,
8 Arkansas Method, Texas Method) select specific flow duration values (e.g., Q_{40} , Q_{80} , 40% of
9 Q_{50} , etc.) by either season or month (Instream Flow Council 2004). None of these methods,
10 however, specify 75 percent of the Q_{50} as does Dr. Benbow. Typically, when a hydrograph is
11 used to set flow, the flow will be based on a specific flow duration value (e.g., Q_{70} or Q_{90}) rather
12 than a variable percentage of a flow duration value. Payne is unaware that Benbow's approach
13 has ever been applied or tested on Hawaiian or any other streams. Therefore, Payne concluded
14 that the argument that 75 percent of the Q_{50} is required to accomplish his stated objectives
15 appears to be based on Benbow's personal judgment and opinion, is unsupported by published
16 literature, and is without implementation history or precedent. (Payne, WDT 10/26/07, ¶ 12,
17 Payne, Tr. 12/12/07, p. 25, l. 25 to p. 26, l. 16.) HC&S FOF 36A.

18 585. Benbow testified that the 75 percent figure is an "informed guess." (Benbow, Tr.
19 12/10/07, p. 172, ll. 2-10.) He also conceded that the amount of flow needed could be less.
20 (Benbow, Tr. 12/10/07, p. 130, l. 19 to p. 131, l. 12.) HC&S FOF 36B.

21 586. Benbow is unaware if any member of the working group at the USGS stakeholder
22 meeting has endorsed recommending to the Commission that the appropriate instream flow
23 standard should be 75 percent of the annual median flow. (Benbow, Tr. 12/10/07, p. 129, ll. 13-
24 18.) HC&S FOF 36C.

25 587. The flow rate recommended by Benbow cannot be sustained because it could exceed the
26 natural flow of the stream. For instance, the Q_{75} of Waihe'e Stream is between 20 to 30 mgd
27 (USGS historical data indicate that the Q_{70} flow of Waihe'e Stream is 29 mgd). Yet, the flow of
28 Waihe'e Stream is frequently less than 20-30 mgd even under undiverted conditions. (Oki, WDT
29 9/14/07, ¶ 53; Benbow, Tr. 12/10/07, p. 132, l. 12 to p. 133, l. 12.) HC&S FOF 37.

1 588. The releases proposed by Benbow for a period of at least five years is his personal
2 opinion and based in part on the lack of scientific understanding about biological communities in
3 the Nā Wai 'Ehā streams. (Benbow, Tr. 12/10/07, p. 62, l. 4 to p. 63, l. 11.) HC&S FOF 39.

4 589. Contrary to Benbow's suggestion that a large volume of flow be restored and sustained
5 for a long period of time, Ford, HC&S's expert witness, recommended that restoration of flows,
6 if any, should begin at a low level and increased incrementally over time. Starting with a low
7 level of releases helps in determining the incremental contributions of flow and their
8 significance. Adequate time should be allowed to study both changes in habitat and biological
9 responses to the releases at each increment. (Ford, Tr. 12/10/07, p. 228, l. 5 to p. 230, l. 12; Ford,
10 Tr. 12/11/07, p. 137, l. 6 to p. 139, l. 4.) Starting with low increases in flows quickly result in a
11 large benefit in terms of increasing the wetted habitat area of a stream. At higher flows, the
12 increase in wetted habitat area from increasing flows becomes much less dramatic. (Payne, Tr.
13 12/12/07, p. 16, l. 13 to p. 20, l. 25.) HC&S FOF 41.

14 590. HC&S's expert witnesses recommended that the addition of flow to Waihe'e River and
15 Waiehu Streams would yield the most benefit in terms of increasing populations of native
16 amphidromous species in the Nā Wai 'Ehā area. (Ford, Tr. 12/10/07, p. 211, ll. 13-16, p. 227, l.
17 24 to p. 228, l. 4; Payne, Tr. 12/12/07, p. 15, l. 23 to p. 16, l. 25; Ford, Tr. 10/18/08, p. 236, ll.
18 13-17.) The key is to place flow in streams in which existing alterations of habitat are minimal.
19 (Ford, Tr. 12/10/07, p. 210, ll. 7-10.) Waihe'e River provides significant habitat for all life
20 stages of native amphidromous species. Waiehu Stream, while not an ideal candidate for
21 restoration due to its narrow channel and cultural disturbances in the middle reaches,
22 nevertheless showed signs of ecological connectivity. By comparison, it is highly questionable
23 whether increased flows in 'Īao Stream would mitigate the impediment to recruitment posed by
24 the channelization of the stream. There is also no definitive evidence that Waikapū Stream ever
25 carried uninterrupted surface waters to the sea. (Exh. E-53, p. 43, § 8.0.) HC&S FOF 66.

26 591. However, in its initial written testimony, SWCA stated "it is possible" that the
27 channelized portion of 'Īao Stream plays a "far greater role" than the lack of water, "though this
28 suggestion must be verified by quantitative study." (Ford, WDT 10/26/07, ¶ 19.) In its final
29 report, SWCA stated it was "our firm belief" that the channel "is the primary factor." (Exh. E-
30 53, p. 44.) Hui/MTF FOF C-103.

1 592. SWCA also admitted that neither the Timbol and Maciolek study it cited, nor any data or
2 study that it knew of, demonstrated that channelization is more important. (Ford, Tr. 12/11/07, p.
3 113, l. 17 to p. 115, l. 7; p. 39, ll. 12-17; Ford, Tr. 10/14/08, p. 151, ll. 9-13.) SWCA's final
4 report claimed the larval drift survey results reinforced this hypothesis, but SWCA admitted that
5 the survey did not address the issue of the relative importance of channelization versus lack of
6 flow. (Ford, Tr. 10/14/08, p. 143, l. 19 to p. 144, l. 6.) Hui/MTF FOF C-104.

7 593. The Division of Aquatic Resources' ("DAR") ongoing biological surveys and monitoring
8 have documented amphidromous recruitment in the channelized section in `Īao Stream during
9 intermittent flows. (Polhemus, Tr. 12/12/07, p. 190, l. 22 to p. 191, l. 4; Exh. C-96 (letter from
10 Mr. Hau, DAR.) Hui/MTF FOF C-109.

11 594. Benbow's studies in `Īao Stream also documented substantial amphidromous migration
12 when flow connected to the ocean for more than three or four days (Benbow, WDT 9/14/07, ¶ 5)
13 and thus anticipated that with continuous flow, amphidromous species would reestablish into the
14 upper reaches of `Īao Stream. (Benbow, Tr. 12/10/07, p. 169, ll. 10-11.) Hui/MTF FOF C-110.

15 595. Benbow's opinion is that no amount of mitigation of other factors such as channelization
16 can compensate for a lack of streamflows; on the other hand, increased streamflows can go a
17 long way to mitigate the adverse effects of other factors. (Benbow, WDT 11/16/07, ¶ 10.)
18 Hui/MTF FOF C-112.

19 596. SWCA also acknowledged that, ultimately, restoration of flow would answer whether
20 Waikapū Stream flows mauka to makai. (Ford, Tr. 12/11/07, p. 117, l. 18 to p. 118, l. 2.) **See**
21 **also** Oki, WDT 9/14/07, ¶ 48; Oki, Tr. 12/6/07, p. 45, ll. 1-8.

22 597. HC&S's expert witnesses concluded further that the contributions of one healthy stream
23 to the populations of amphidromous species in neighboring streams cannot be overlooked. The
24 larval drift sampling conducted by SWCA found large numbers of 'o'opu larvae in Waihe'e
25 Stream and none in the three other streams. This suggests that Waihe'e Stream contributes
26 thousands of 'o'opu larvae to the oceanic pool. On a regional basis, this tends to compensate for
27 the absence of significant reproducing populations in the other three Nā Wai 'Ehā Streams.
28 (Lindstrom, Tr. 10/18/08, p. 45, ll. 12-20; Exh. E-53, p. 42 and Table 7 (§ 7.5.2), and 44 (§ 9.0).)
29 HC&S FOF 67.

1 598. On the other hand, Benbow was of the opinion that each stream is a natural system, and
2 differences in the characteristics of the streams and their watersheds should be taken into account.
3 (Benbow, WDT 9/14/07, ¶ 23), Hui/MTF FOF C-102.

4 599. In federal fiscal year 2006, the USGS initiated a study, which included: (1) compiling
5 and analyzing existing information relevant to the Waihe`e River, and Waiehu, `Īao, and
6 Waikapū Streams, (2) conducting baseline reconnaissance surveys of the streams to identify sites
7 of diversion and return flow and significant gaining and losing reaches, (3) establishing low-flow
8 partial-record stations in reaches with flowing water to characterize natural and current diverted
9 flows in Nā Wai `Ehā streams, (4) establishing temperature-monitoring sites in reaches with
10 flowing water to provide information on temperature variations for diverted and undiverted
11 conditions, (5) monitoring the frequency of dry days in selected reaches of the diverted streams
12 to establish the number of days during which continuous mauka to makai flow is available for
13 the upstream movement of native species, (6) surveying the presence or absence of native and
14 non-native aquatic species in selected stream reaches to provide baseline data for assessing
15 effects of streamflow restoration, (7) collecting macrohabitat, microhabitat, and channel-
16 geometry information in selected study reaches downstream from existing diversions to
17 characterize the effects of diversions on habitat for native stream macrofauna, and (8) analyzing
18 data and producing a report summarizing the study findings. (Oki, WDT 9/14/07, ¶¶ 28-36; Oki,
19 Tr. 12/6/07, p. 39, l. 25 to p. 52, l. 25.) Hui/MTF FOF B-116.

20 600. The USGS's cooperative study of Nā Wai `Ehā streams is funded by a consortium of
21 county, state, and federal partners, including this Commission. (Oki, Tr. 12/6/07, p. 137, ll. 6-9.)
22 Hui/MTF FOF B-117.

23 601. USGS collected qualitative flow information at selected sites downstream of diversions
24 on Waihe`e River (3), Waiehu Stream (2), `Īao Stream (3), and Waikapū Stream (2). (Oki, WDT
25 9/14/07, ¶ 43.) Hui/MTF FOF B-120.

26 602. Photographic information from cameras mounted at three selected sites downstream of all
27 diversions established that from September 2006 to July 2007 North Waiehu Stream was dry
28 about 79 percent of the time, `Īao Stream was dry about 70 percent of the time, and Waikapū
29 Stream was dry about 37 percent of the time. (Oki, WDT 9/14/07, ¶ 43.) Hui/MTF FOF B-120 .
30 Waihe`e and Spreckels Ditches on Waihe`e River are capable of diverting all of the dry-weather
31 flow available at the intakes. However, streamflow immediately downstream of the intakes may

1 exist because of leakage through or subsurface flow beneath the dams at these sites. Estimated
2 dry-weather flow immediately downstream of the Waihe`e and Spreckels Ditch intakes
3 commonly is on the order of about 0.1 mgd, but the stream may not have continuous surface
4 flow from mauka to makai. (Oki, WDT 9/14/07, ¶ 44.)

5 603. For the USGS's Nā Wai `Ehā study, data are being collected to evaluate the effects of
6 diversions on physical habitat for native aquatic species. (Oki, WDT 9/14/07, ¶ 49.) Although
7 data are not yet available to fully describe the relation between physical habitat and streamflow
8 for Waihe`e River and Waiehu, `Īao, and Waikapū Streams, in general, for low-flow conditions
9 (less than median flow), the availability of suitable physical habitat generally increases as
10 streamflow increases. (Id.) Hui/MTF FOF B-122.

11 604. A critical component of the USGS study is the need to partially or fully restore flow to
12 create streams that flow along their entire length during the period of study. Controlled releases
13 have been and continue to be requested to allow measurements of streamflow, infiltration (loss
14 of water into the underlying stream bed), and physical habitat (and possibly recruitment and
15 larval drift) for different flow conditions in sections of the stream that commonly are dry under
16 diverted conditions. (Oki, WDT 9/14/07, ¶ 50.)

17 605. The controlled releases are not designed to predict the abundance of native aquatic
18 species for different streamflow conditions. (Oki, WDT 9/14/07, ¶ 49.) It is intended to study the
19 effect of different flow conditions on habitat, not to predict the biological response of the stream
20 to the flow conditions. (Oki, WDT 9/14/07, ¶ 5.) Population abundance is only indirectly
21 inferred, without any direct quantification or prediction of individual species numbers or density.
22 (Oki, Tr. 12/6/07, p. 158, l. 15 to p. 159, l. 17.)

23 606. "The results are intended to be used along with other biological and hydrological
24 information in development, negotiations, or mediated settlements for instream flow
25 requirements (Gingerich and Wolff, 2005)." (Payne, WDT 10/26/07, ¶ 10.) HC&S FOF 32C.

26 607. Payne, HC&S's expert witness, recommends use of the Demonstration Flow Assessment
27 (DFA) method in place of the method used by USGS to modify interim instream flow standards.
28 DFA relies on direct observation of stream characteristics rather than complex computations of
29 hydraulics and habitat suitability. Persons representing the various instream flow needs identified
30 for assessment (e.g., fish habitat, recreation, aesthetics, native Hawaiian values, cultivation, etc.)
31 observe and objectively evaluate conditions and develop a consensus rating of different flows

1 through collaborative discussion. (Payne, WDT 10/26/07, ¶ 13.) While the DFA still requires
2 interpretation, it can be subject to negotiation and vests all parties with direct knowledge of
3 stream conditions under various flow alternatives. (Payne, WDT 10/26/07, ¶ 14.) DFA can be
4 done concurrently with USGS's method at no additional cost of water or time. The same study
5 sites can be evaluated (if appropriate) with the two methods at the same flow levels over the
6 same one-to-three day time frame. (Payne, WDT, ¶ 15.) HC&S FOF 33.

7 608. USGS has proposed a series of controlled releases into Waihe'e River, Waiehu Stream,
8 and 'Īao Stream to allow measurements of streamflow, infiltration, and physical habitat under
9 different flow conditions. No controlled releases were proposed for Waikapū Stream. The
10 releases would be done in three stages, with each stage involving a flow rate higher than the last.
11 The higher streamflow-restoration rates could be refined as additional information becomes
12 available to better estimate loss rates. Each restoration condition should be maintained for a
13 period of time sufficient to allow flow conditions to stabilize and measured loss rates in a reach
14 to vary by less than 10 percent on three different days. (Oki, WDT 9/14/07, ¶¶ 50, 51, 56, 60, 64,
15 Table 1.) HC&S FOF 30.

16 609. The controlled releases would be simultaneous for all three streams, but to minimize
17 disruption to regular ditch operations, a phased approach was proposed, starting first at Waihe'e
18 River, then Waiehu Stream, and finally 'Īao Stream. (Oki, Tr. 12/6/07, p. 165, ll. 21-24; Oki,
19 WDT 9/14/07, ¶ 51.)

20 610. USGS stated that control releases would be helpful to resolve whether or not Waikapū
21 Stream flowed continuously to the ocean under natural conditions and that a schedule of
22 controlled releases for Waikapū Stream could be developed in the future. (Oki, WDT 9/14/07, ¶
23 51.)

24 611. For Waihe'e Stream, USGS proposed maintaining flows near the coast of about 6.5 mgd,
25 13 mgd, and 26 mgd, which USGS estimates would require flows just downstream of the
26 Spreckels Ditch diversion of 10 mgd, 17 mgd, and 30 mgd, respectively, assuming a constant
27 streamflow loss of 4 mgd downstream of the Spreckels Ditch diversion. (Oki, WDT 9/14/07, ¶
28 56, Table 1.) HC&S FOF 30A.

29 612. Flows of 10 mgd, 17 mgd, and 30 mgd just upstream of the first diversion at the Waihe'e
30 Ditch are less than the minimum, Q_{99} , and Q_{68} flows, respectively. (Oki, WDT 9/14/07, ¶ 56.)

1 613. For North and South Waiehu Streams, USGS proposed maintaining flows near the coast
2 of 0.6 mgd, 1.6 mgd, and 2.6 mgd, which USGS estimates would require flows of: 1) 1.6 mgd at
3 the North Waiehu Ditch on North Waiehu Stream plus 0.9 mgd at Spreckels Ditch on South
4 Waiehu Stream; 2) 2.2 mgd at the North Waiehu Ditch on North Waiehu Stream plus 1.3 mgd at
5 Spreckels Ditch on South Waiehu Stream; and 3) 2.9 mgd at the North Waiehu Ditch on North
6 Waiehu Stream plus 1.6 mgd at Spreckels Ditch on South Waiehu Stream. This assumes: 1) an
7 estimated streamflow loss in North Waiehu Stream between the North Waiehu Ditch and the
8 confluence of North and South Waiehu Stream of about 1.3 mgd, and 2) an estimated streamflow
9 loss in Waiehu Stream between the confluence of North and South Waiehu Stream and the coast
10 of 0.6 mgd. (Oki, WDT 9/14/07, ¶ 60.) HC&S FOF 30B.

11 614. For North Waiehu Stream, flows of 1.6 mgd, 2.2 mgd, and 2.9 mgd upstream of all
12 diversions are equal to the minimum, Q_{90} , and between the Q_{70} and Q_{50} flows, respectively. (Oki,
13 WDT 9/14/07, ¶ 24.) For South Waiehu Stream upstream of most diversions (a small kalo ditch
14 diverted about 0.06 mgd to 0.2 mgd upstream of the stream-gaging station): a flow of 0.9 mgd is
15 less than the minimum measurement of 1.5 mgd, and flows of 1.3 mgd and 1.6 mgd is within the
16 range of the Q_{90} of 1.3 mgd to 2.0 mgd. (Oki, WDT 9/14/07, ¶ 25.)

17 615. For 'Īao Stream, USGS proposed maintaining flows near the coast of about 3.2 mgd, 9.7
18 mgd, and 16 mgd, which USGS estimates would require flows just downstream of the 'Īao-
19 Maniania Ditch diversion of 9.5 mgd, 16 mgd, and 22 mgd, respectively, based on an estimated
20 loss of 6.3 mgd, approximately 4.2 mgd between the 'Īao-Maniania Ditch and the Spreckels
21 Ditch and 2.1 mgd below the Spreckels Ditch. (Oki, WDT 9/14/07, ¶ 62-64.) HC&S FOF 30C.

22 616. Flows of 9.5 mgd, 16 mgd, and 22 mgd upstream of all diversions represent the Q_{97} , Q_{75} ,
23 and Q_{56} flows, respectively.

24 617. While controlled releases for Waikapū Stream were deferred, the USGS estimates for
25 streamflow above all diversions were 4.8 mgd to 6.3 mgd for Q_{50} , 3.9 mgd to 5.2 mgd for Q_{70} ,
26 and 3.3 mgd to 4.6 mgd for Q_{90} . However, gaging station 16650000, at altitude of about 880 feet,
27 is located below the South Side Waikapū Ditch, at an altitude of about 1,120 feet, but these
28 estimates include water diverted by that Ditch. Thus, the actual flow should be less than the
29 historical natural flow at gaging station 16650000 by the amount still being diverted by the South
30 Side Waikapū Ditch. However, the record-extension estimates of flows in climate years 1984 to
31 2005 for gaging station 1665000 should be the same for the flows above the South Side Waikapū

- 1 Ditch, because USGS's estimates of natural flow assume no gains, losses, or return flows
- 2 between the South Side Waikapū Ditch diversion and station 16650000 during the period when
- 3 the gaging stations were operated. FOF 134, *supra*.

1
2
3 **II. CONCLUSIONS OF LAW**

4 **A. OVERVIEW OF APPLICABLE LAW**

5 **1. Instream Flow Standards**

6 1. “‘Instream flow standard’ means a quantity of water or depth of water which is
7 required to be present at a specific location in a stream system at certain specified times
8 of the year to protect fishery, wildlife, recreational, aesthetic, scenic, and other beneficial
9 instream uses.” HRS §174C-3.

10 2. “‘Interim instream flow standard’ means a temporary instream flow standard of
11 immediate applicability, adopted by the commission without the necessity of a public
12 hearing, and terminating upon the establishment of an instream flow standard.” HRS
13 §174C-3.

14 3. The (instream flow standard) is the surface water corollary to the ground water
15 “sustainable yield” in that both perform the function of guiding water planning and
16 regulation by prescribing responsible limits to the development and use of public water
17 resources. In re Water Permit Applications, 94 Haw. 97, at 148; 9 P.3d 409, at 460 (2000)
18 (“Waiāhole I”).

19 4. “Any person with the proper standing may petition the commission to adopt an
20 interim instream flow standard for streams in order to protect the public interest, pending
21 the establishment of a permanent instream flow standard...A petition...shall set forth
22 data and information concerning the need to protect and conserve beneficial instream
23 uses of water and any other relevant and reasonable information required by the
24 commission. In considering a petition to adopt an interim instream flow standard, the
25 commission shall weigh the importance of the present or potential instream values with
26 the importance of the present or potential uses of water for noninstream purposes,
27 including the economic impact of restricting such uses.” HRS §174C-71(2); HAR §13-
28 169-40.

29 5. “Instream use” means beneficial uses of stream water for significant purposes
30 which are located in the stream and which are achieved by leaving the water in the
31 stream. Instream uses include, but are not limited to:

- 32 (1) Maintenance of fish and wildlife habitats;

- 1 (2) Outdoor recreational activities;
- 2 (3) Maintenance of ecosystems such as estuaries, wetlands, and stream
- 3 vegetation;
- 4 (4) Aesthetic values such as waterfalls and scenic waterways;
- 5 (5) Navigation;
- 6 (6) Instream hydropower generation;
- 7 (7) Maintenance of water quality;
- 8 (8) The conveyance of irrigation and domestic water supplies to downstream
- 9 points of diversion; and
- 10 (9) The protection of traditional and customary Hawaiian rights.

11 HRS §174C-3.

12 6. “Noninstream use” means the use of stream water that is diverted or removed
13 from its stream channel and includes the use of stream water outside of the channel for
14 domestic, agricultural, and industrial purposes. HRS §174C-3.

15

16 **2. Water Use Permit Applications (“WUPAs”)**

17 7. Each WUPA must demonstrate that the proposed use of water (1) can be
18 accommodated with the available water source, (2) is a reasonable-beneficial use, (3) will
19 not interfere with any existing legal use of water, (4) is consistent with the public interest,
20 (5) is consistent with state and county general plans and land use designations, (6) is
21 consistent with county land use plans and general policies, and (7) will not interfere with
22 the rights of the Department of Hawaiian Home Lands. HRS §174C-49(a).

23 8. “Reasonable-beneficial use” is the use of water in such a quantity as is necessary
24 for economic and efficient utilization, for a purpose, and in a manner which is both
25 reasonable and consistent with the state and county land use plans and the public
26 interest.”HRS § 174C-3.

27 9. In addition to meeting the constitutionally mandated standard of reasonable-
28 beneficial use, an applicant for a water use permit must affirmatively demonstrate that its
29 proposed use satisfies all the other criteria set forth in Haw. Rev. Stat. § 174C-49(a).

30 **Waiāhole I**, 94 Haw. at 160-61, 9 P.3d at 472-73; **Waiāhole II**, 105 Haw. at 15-16, 93
31 P.3d at 657-58.

1 **3. Water as a Public Trust**

2 10. Under article XI, sections 1 and 7 of the Hawaii Constitution, the public trust
3 doctrine applies to all water resources without exception or distinction. **Waiāhole I**, 94
4 Haw. at 133; 9 P.3d at 445.

5 11. The public trust mandate is to conserve and protect water resources as well as to
6 use and develop them in a reasonable and beneficial manner. “(T)he State...shall
7 conserve and protect Hawaii’s...water... and shall promote the development and
8 utilization of these resources in a manner consistent with their conservation and in
9 furtherance of the self-sufficiency of the State.” Hawaii State Constitution, Article XI, §1.
10 “The state water resources trust thus embodies a dual mandate of 1) protection and 2)
11 maximum reasonable and beneficial use.” **Waiāhole I**, 94 Haw. at 139; 9 P.3d at 451. “In
12 short, the object is not maximum consumptive use, but rather the most equitable,
13 reasonable, and beneficial allocation of state water resources, with full recognition that
14 resource protection also constitutes ‘use.’” **Waiāhole I**, 94 Haw. at 140; 9 P.3d at 452.

15 12. Each offstream user must prove that each specific use is reasonable-beneficial by
16 providing details on “acres to be used, the crops to be planted, and the water needed as to
17 each group.” In re Waiāhole Ditch Combined Contested Case Hr’g, 105 Haw. 1, at 25, 93
18 P.3d 643, at 667 (2004) (“**Waiāhole II**”). Absent such basic information, an offstream
19 user cannot meet its legal burden. Id. at 26, 93 P.3d at 668.

20 13. The purposes of the water resources trust are: 1) maintenance of waters in their
21 natural state; 2) domestic water use of the general public; 3) Native Hawaiian and
22 traditional and customary rights, including appurtenant rights; and 4) reservations of
23 water for Hawaiian home lands. **Waiāhole I**, 94 Haw. at 136-138; 9 P.3d at 448-450. In
24 re Wai`ola o Moloka`i, Inc., 103 Haw. 401, at 429, 431, 83 P.3d 664, at 692, 694 (2004)
25 (“**Wai`ola**”).

26 14. There are no absolute priorities among these trust purposes; i.e., protection of the
27 resource is not a “categorical imperative.” **Waiāhole I**, 94 Haw. at 142, 9 P.3d at 454.

28 15. “(I)nsofar as the public trust, by nature and definition, establishes use consistent
29 with trust purposes as the norm or ‘default’ condition...it effectively prescribes a ‘higher
30 level of scrutiny’ for private commercial uses...In practical terms, this means that the

1 burden ultimately lies with those seeking or approving such uses to justify them in light
2 of the purposes protected by the trust.” Waiāhole I, 94 Haw. at 142; 9 P.3d at 454.

3 16. The Commission is to “weigh competing public and private water uses on a case-
4 by-case basis, according to any appropriate standards provided by law” and
5 “accommodating both instream and offstream uses where feasible.” Waiāhole I, 94 Haw.
6 at 142; 9 P.3d at 454.

7 17. “(T)he public trust compels the state duly to consider the cumulative impact of
8 existing and proposed diversions on trust purposes and to implement reasonable measures
9 to mitigate this impact, including using alternative resources.” Waiāhole I, 94 Haw. at
10 143; 9 P.3d at 455.

11 18. After an IIFS has been established, water available over the amount that must
12 remain in the stream is available for offstream uses. However, water not actually put to
13 reasonable-beneficial use would be wasted and must remain in the streams. Waiāhole I,
14 94 Haw. at 118, 156, 9 P.3d at 430, 468.

15 16 **4. Traditional and Customary Rights**

17 19. In addition to appurtenant rights when practiced for subsistence, cultural and
18 religious purposes, traditional and customary rights include, but are not limited to,
19 kuleana water for domestic purposes, kalo cultivation, and other irrigation purposes, and
20 the gathering of hihiwai, opae, o`opu, limu, thatch, ti leaf, aho cord, and medicinal plants
21 for subsistence, cultural, and religious purposes. Haw. Rev. Stat. § 174C-101(c).
22 Waiāhole I, 94 Haw. at 137, 9 P.3d at 449.

23 20. Traditional and customary rights cannot be abandoned, and are guaranteed even if
24 the practice has not been continually practiced in an area. Public Access Shoreline Haw.
25 v. Hawai`i Planning Comm`n, 79 Haw. 425, at 450, 903 P.2d 1246, at 1271 (1995)
26 (“Pash”).

27 28 **5. Appurtenant rights**

29 21. “The trust’s protection of traditional and customary rights also extends to the
30 appurtenant rights recognized in *Peck*.” Waiāhole I, 94 Haw. at 137 n. 34; 9 P.3d at 449,
31 n. 34. However, *Peck* had concluded that an appurtenant right may be used for any

1 purpose: “(O)riginally the water was wanted mainly for the cultivation of kalo and more
2 recently for cane. If land has a water right, it will not be contended that the water shall be
3 used forever for the same crop, be it kalo or cane. It may be used for any purpose which
4 the owner may deem for his interest, always taking care that any change does not affect
5 injuriously the rights of others.” **Peck v Bailey**, 8 Haw. 658, at 665 (1867).

6 22. By including appurtenant rights within Native Hawaiian and traditional and
7 customary rights, the Court presumably has limited that inclusion to appurtenant rights
8 that are exercised for subsistence, cultural or religious purposes. “The State reaffirms and
9 shall protect all rights, customarily and traditionally exercised for subsistence, cultural
10 and religious purposes and possessed by ahupua`a tenants who are descendants of native
11 Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the right of the
12 State to regulate such rights.” Hawaii State Constitution, Article XII, §7. “(W)hile the
13 state water resources trust acknowledges that private use for ‘economic development’
14 may produce important public benefits and that such benefits must figure into any
15 balancing of competing interests in water, it stops short of embracing private commercial
16 use as a protected ‘trust purpose’... (I)f the public trust is to retain any meaning and
17 effect, it must recognize enduring public rights in trust resources separate from, and
18 superior to, the prevailing private interests in the resource at any given time.” **Waiahole**
19 **I**, 94 Haw. at 138; 9 P.3d at 450.

20 23. However, the Constitution and the State Water Code preserve appurtenant rights,
21 whether being exercised or not at the time the area in which those rights pertain to is
22 designated a water management area. Hawaii State Constitution, Article XI, §7; State
23 Water Code, HRS §174C-63, §174C-27, §174C-101(d). “The Code contains no
24 comparable provisions preserving riparian (surface water) and correlative (ground water)
25 ‘rights’.” **Waiahole I**, 94 Haw. at 179; 9 P.3d at 491. Thus, only riparian and correlative
26 rights that were being exercised on April 30, 2008, the time of water management area
27 designation, qualify for existing-use water permits. FOF 26. Future uses no longer are
28 based on riparian or correlative rights, which are extinguished as of the date of water
29 management area designation, and have no priority over other permit applicants.

30 24. Under the State Water Code, not only is the exercise of an appurtenant right
31 preserved, but the exercise of that right has priority over other uses in the issuance of a

1 water use permit: “Appurtenant rights are preserved. Nothing in this part shall be
2 construed to deny the exercise of an appurtenant right by the holder thereof at any time.
3 A permit for water use based on an existing appurtenant right shall be issued upon
4 application. Such permit shall be subject to sections 174C-26 and 174C-27 and 174C-58
5 to 174C-62.” HRS §174C-63.

6 25. The Code does subject water uses under appurtenant rights to the shortage
7 provisions of section 174C-62: The Commission may impose restrictions “as may be
8 necessary to protect the water resources of the area from serious harm and to restore them
9 to their previous condition...including but not limited to apportioning, rotating, limiting,
10 or prohibiting the use of the water resources of the area.”

11 26. However, whether intentionally or inadvertently, HRS §174C-63 does not subject
12 the exercise of appurtenant rights to section 174C-49, the “Conditions for a permit”
13 section of the Code, which includes a requirement that the proposed use of water “(i)s a
14 reasonable-beneficial use as defined in section 174C-3.” But the public trust mandate is
15 to conserve and protect water resources as well as to use and develop them in a
16 reasonable and beneficial manner. COL 11, *supra*. Thus, appurtenant uses must also be
17 undertaken for reasonable-beneficial uses.

18 27. “[T]he right to the use of water acquired as appurtenant rights may only be used
19 in connection with that particular parcel of land to which the right is appurtenant[.]”
20 McBryde Sugar Co. v. Robinson, 54 Haw. 174, at 191, 504 P.2d 1330, at 1341 (1973);
21 *affd on rehearing*, 55 Haw. 260, 517 P.2d 26 (1973); *appeal dismissed for want of*
22 *jurisdiction and cert. denied*, 417 U.S. 962 (1974) (“**McBryde**”).

23 28. “(A)ppurtenant water right(s) to taro land attached to the land when title was
24 confirmed by the Land Commission Award and title conveyed by the issuance of Royal
25 Patent.” **McBryde**, 54 Haw. at 190, 504 P.2d at 1340; **see also** Territory v. Gay, 31 Haw.
26 376, at 383 (1930); *aff’d*, 52 F.2d 356 (9th Cir. 1931); *cert. denied*, 284 U.S. 677 (1931)
27 (“**Territory v Gay**”).

28 29. “(W)hile the proper measure of those rights is indeed the quantum of water
29 utilized at the time of the Mahele, requiring too great a degree of precision in proof
30 would make it all but impossible to ever establish such rights.” When “the same parcel of
31 land is being utilized to cultivate traditional products by means approximating those

1 utilized at the time of the Mahele, there is sufficient evidence to give rise to a
2 presumption that the amount of water diverted for such cultivation sufficiently
3 approximates the quantity of the appurtenant water rights to which that land is entitled.”
4 Reppun v. Board of Water Supply, 65 Haw. 531, at 554, 656 P.2d 57, at 72 (1982)
5 (“Reppun”).

6 30. Appurtenant rights must be recognized, the amounts of water accompanying those
7 rights must be determined, and the Commission is the authority for doing so: “(The
8 Commission) (s)hall determine appurtenant water rights, including quantification of the
9 amount of water entitled to by that right.” HRS §174C-5(14).

10

11 **6. Alternative Sources**

12 31. An alternative is practicable if it is available and capable of being used after
13 taking into consideration cost, existing technology, and logistics. Waiāhole II, 105 Haw.
14 at 19, 93 P.3d at 661.

15 32. An applicant’s inability to afford an alternative source of water, standing alone,
16 does not render that alternative impracticable. Waiāhole II, 105 Haw. at 19, 93 P.3d at
17 661.

18 33. An alternative source of water is not rendered impracticable simply because an
19 offstream user does not own or control the source. Waiāhole II, 105 Haw. at 17, 93 P.3d
20 at 659.

21 34. The Commission “is not obliged to ensure that any particular user enjoys a
22 subsidy or guaranteed access to less expensive water sources when alternatives are
23 available and public values are at stake.” Waiāhole I, 94 Haw. at 165, 9 P.3d at 477.

24

25 **7. Losses**

26 35. Offstream users have the burden to prove that any system losses are reasonable-
27 beneficial by establishing the lack of practicable mitigation measures, including repairs,
28 maintenance, and lining of ditches and reservoirs. Waiāhole I, 94 Haw. at 172-73, 9 P.3d
29 at 484-85; Waiāhole II, 105 Haw. at 27, 93 P.3d at 669.

30 36. Whether or not a permit is required for system losses, offstream users, and
31 ultimately the Commission, must account for water lost or missing by adopting

1 “provisions that encourage system repairs and limit losses.” Waiāhole II, 105 Haw. at
2 27, 93 P.3d at 669.

3
4 **8. Surface Water Diversions: The WUPA Process Versus This CCH**

5 37. “(B)esides advocating the social and economic utility of their proposed uses,
6 permit applicants (in the WUPA or water use permit application proceedings) must also
7 demonstrate the absence of practical mitigating measures, including the use of alternative
8 water sources. Such a requirement is intrinsic to the public trust, the statutory instream-
9 use protection scheme, and the definition of ‘reasonable-beneficial’ use, and is an
10 essential part of any balancing between competing interests.” Waiāhole I, 94 Haw. at
11 161; 9 P.3d at 473.

12 38. Permits for noninstream uses can be issued only to the extent that stream flows in
13 excess of the amended IIFS are available. COL 3, *supra*. But in establishing the IIFS in
14 the first place, the Commission must weigh the importance of the present or potential
15 instream values with the importance of the present or potential uses of water for
16 noninstream purposes, including the economic impact of restricting such uses. COL 4,
17 *supra*.

18 39. In WUPAs, permit applicants must show that their uses are reasonable and
19 beneficial and that there are no practical alternative resources. COL 12, *supra*. The Nā
20 Wai `Ehā streams were designated as a surface water management area, with an effective
21 date of designation of April 30, 2008. Applicants for existing–use permits had to be filed
22 within a period of one year from the effective date of designation, or no later than April
23 30, 2009. FOF 26; HRS §174C-50(c). New uses may be filed at any time and will be
24 considered after the existing use determinations have been made. HRS §§174C-49 and
25 174C-51.

26 40. This CCH is limited to the `Īao high-level ground water WUPAs and the petition
27 to amend the IIFS. FOF 18. Thus, it cannot make the final determination of the amounts
28 of noninstream uses that would meet the statutory requirements for water use permits for
29 existing and future uses of diverted surface waters.

30 41. However, in determining the IIFS, many of the same noninstream existing and
31 future uses of water must be evaluated in this CCH. COL 4, *supra*. Thus, the Commission

1 must make a collective finding on these noninstream uses in order to meet its duty of
2 finding a balance between instream and noninstream uses to establish the IIFS.

3 42. In its assessment of noninstream uses in this CCH, the Commission must also
4 determine whether or not the amounts of water being diverted for noninstream purposes
5 are justifiable—i.e., reasonable-beneficial uses—in order to evaluate “the importance of
6 the present or potential uses of water for noninstream purposes, including the economic
7 impact of restricting such uses.” COL 4, *supra*. The importance of such uses cannot
8 apply to water that may be used in an unreasonable manner and/or amount, which would
9 be contrary to the public trust’s duty of both protection and maximum reasonable and
10 beneficial use, COL 11, *supra*, and the Commission’s duty to uphold that trust.

11 43. For a water-use permit application, the costs of alternative sources would be
12 considered in the determination of the practicability of those alternative sources. In
13 amending the IIFS, the costs of available alternative sources for noninstream uses would
14 not be included in the economic impact of restricting such noninstream uses because it is
15 intrinsic to the definition of “reasonable-beneficial” use. COL 37, *supra*.

16

17 **B. PRESENT OR POTENTIAL INSTREAM VALUES**

18 “Instream use” means beneficial uses of stream water for significant purposes
19 which are located in the stream and which are achieved by leaving the water in the stream.
20 COL 5, *supra*.

21 In this CCH, such beneficial uses include:

22 44. maintenance of fish and wildlife habitats, FOF 40, 42, 50, 556;

23 45. outdoor recreational activities, FOF 234;

24 46. maintenance of ecosystems such as estuaries, wetlands, and stream vegetation,
25 FOF 63-79, 234, 237, 303;

26 47. aesthetic values such as waterfalls and scenic waterways, FOF 38, 237, 303;

27 48. conveyance of irrigation and domestic water supplies to downstream points of
28 diversion, FOF 60, 214-236; and

29 49. protection of traditional and customary Hawaiian rights, FOF 35-37, 39-43, 47, 49,
30 51-59, 234, 556. These are rights that are located in the streams and achieved by
31 leaving/restoring water in the streams. COL 5, *supra*. They are distinct from the

1 traditional and customary rights that are included in noninstream purposes; i.e.,
2 appurtenant rights exercised through traditional and customary methods, discussed *infra*.

3 The amounts of stream waters to be restored to address these instream purposes
4 are discussed in section G on Interim Instream Flow Standards (“IIFS”).

5
6 **C. PRESENT OR POTENTIAL USES FOR NON-INSTREAM PURPOSES**

7 “Noninstream use” means the use of stream water that is diverted or removed
8 from its stream channel and includes the use of stream water outside of the channel for
9 domestic, agricultural, and industrial purposes. COL 6, *supra*.

10 In this CCH, noninstream uses include:

11 50. domestic purposes, FOF 233, 238-239;

12 51. agricultural purposes, FOF 233, 238-239, 241, 244, 250, 253, 255, 260-289, 363;

13 and

14 52. industrial purposes, 238-239, 363.

15 In this CCH, the Commission makes a collective finding on the reasonableness of
16 these noninstream uses in order to meet its duty of weighing instream and noninstream
17 uses to establish the IIFS; the Commission does not make the final determination of the
18 amounts of noninstream uses that would meet the statutory requirements for water use
19 permits, which will be addressed through the WUPA process for Nā Wai `Ehā as a
20 surface water management area. FOF 26. COL 40-42, *supra*.

21
22 **1. Kuleana Lands and Maui Coastal Land Trust (“MCLT”)**

23 53. As of the close of the evidentiary phase of this CCH, there were no petitions to
24 the Commission from kuleana landowners for appurtenant rights and the amounts of
25 water that such rights would be entitled to from the Nā Wai `Ehā streams, as required by
26 law. COL 30, *supra*.

27 54. Even without recognized appurtenant rights, current users of Nā Wai `Ehā waters
28 qualify as existing uses if their WUPAs are filed with and accepted by the Commission
29 by April 30, 2009. FOF 26. Current users that do not file for existing-use permits by the
30 deadline may file after the deadline as new uses, and kuleana landowners who
31 successfully petition for recognition of their claimed appurtenant rights may subsequently

1 submit WUPAs for the amounts of water recognized as accompanying those rights. COL
2 23, *supra*.

3 54. A reasonable amount for consumptive use by kalo lo`i (evaporation, transpiration,
4 and percolation through the bottoms and leakage through the banks) is between 15,000 to
5 40,000, FOF 321-322, and most of the net loss between lo`i inflow and outflow is
6 percolation and leakage, FOF 339.

7 55. For proper kalo cultivation, a substantially greater amount of water is needed for
8 inflow above what is consumed, FOF 337. At times of peak use, at least 260,000 gad
9 mean (average) flow or 150,000 gad median (50 percent of flows above, and 50 percent
10 below 150,000 gad) flow is needed, FOF 325. However, during a crop cycle of 14
11 months, no water is required to enter the lo`i approximately 40 to 50 percent of the time,
12 either because of cultural practices including planned resting or fallowing of patches.
13 FOF 330.

14 56. The Commission estimates that current kuleana lands receive more than 130,000
15 to 150,000 gad for their kalo lo`i, FOF 332-333, translating to about 260,000 to 300,000
16 gad when adjusted for the 50 percent of time that no water is needed to flow into the lo`i,
17 FOF 330. These amounts would be sufficient for proper kalo cultivation and even meet
18 Reppun's estimate of sufficient flow, FOF 328.

19 57. However, kuleana users testified that their water deliveries were inadequate, FOF
20 335, and together with observations of numerous leakages from the ditches, FOF 336, the
21 Commission further concludes that much of the water reported by WWC as being
22 delivered to the kuleana lands is being lost between the kuleana lands and WWC's
23 ditches and reservoirs from which the kuleana ditches/pipes emanate. These losses are
24 addressed, in Section E on Losses, *infra*.

25 58. The large amounts of inflow and outflow required for proper kalo cultivation
26 would result in substantial losses, so as much of the outflow as practical must be
27 channeled back into the streams. FOF 337.

28 59. The Commission concludes that water use permits are the proper approach to
29 account for the consumptive use, but not for the larger amounts needed to flow through
30 the lo`i for proper cultivation. While the large amounts of flow-through are reasonable for
31 proper kalo cultivation, water use permits effectively remove those large amounts from

1 all other uses; i.e., maintaining/restoring stream flows and other reasonable-beneficial
2 offstream uses. Whether or not a permit is required, the Commission must account for
3 water losses by adopting provisions that limit such losses. COL 36, *supra*. Those
4 provisions are presented in Section E on Losses, *infra*.

5 60. Kuleana lands also use stream waters for domestic and other uses (vegetables,
6 trees, and plants). FOF 233. MDWS has allocated up to 540 gpd for households and 600
7 to 1,200 gpd for agricultural development lots, FOF 401-402, which are reasonable
8 amounts for kuleana lands for those purposes. The kalo lo`i reasonable use at between
9 15,000 to 40,000 gad, however, is by far the dominant use, and the higher consumptive
10 rate of 40,000 gad would be more than enough to account for domestic and other use.
11 Thus, reasonable use for kuleana lands would be about 1.71 mgd. FOF 219-220.

12 61. MCLT seeks 1.5 to 2.5 mgd to restore its wetlands by raising the water table
13 elevation between 12 to 18 inches and running freshwater through its fishpond to restore
14 aquaculture conditions within the ancient fishpond limits. FOF 345. There was no
15 testimony against these amounts being reasonable for the stated purposes, with the
16 testimony focused on whether or not the underlying basal aquifer was a practical
17 alternative to water from the Waihe`e River. FOF 353.

18

19 2. MDWS

20 62. All of MDWS's basal and high-level water sources in the `Iao Ground Water
21 Management Area and its surface water sources from Nā Wai `Ehā are part of its
22 integrated Central Maui System. FOF 362. In issuing water use permits to MDWS for its
23 seven basal sources and for Shaft 33 in CCH-MA05-1 of January 31, 2007, the
24 Commission found that MDWS's use met all of the requirements of HRS §174C-49(a),
25 including that the uses were reasonable-beneficial. Therefore, its existing uses of surface
26 water, FOF 239, 368, are for the same purposes, and the amounts of those uses would be
27 reasonable. Of its 3.2 mgd capacity, MDWS used only 0.71 mgd in 2005 and 1.08 mgd in
28 2006, or an average of 0.9 mgd. Table 7. Furthermore, its informal discussions to
29 increase capacity from 3.2 to 4.0 mgd and to construct a new water treatment facility of
30 up to 9 mgd capacity are too speculative. FOF 305-306. Thus, at most, MDWS's present
31 and potential reasonable uses is 3.2 mgd.

1 **3. WWC Water Delivery Agreements**

2 63. Of the 34 entities in addition to MDWS and HC&S who have water-delivery
3 agreements with WWC, except for testimony provided by some of these entities, only the
4 total actual uses and general descriptions of these uses were identified. FOF 240-241,
5 256-258, 377. Out of maximum delivery agreements of 8.288 mgd, total use for the 34
6 entities were 1.42 mgd in 2005 and 2.37 mgd in 2006. FOF 257-258.

7 64. For two of the larger current or future users, reasonable amounts are 1.2 mgd or
8 less for two golf courses, FOF 391, 395, and 2,730 gad for a proposed coffee farm of
9 about 300 acres, FOF 388-389, or 0.82 mgd, for a total of 2.02 mgd.

10 65. There are also at least two agricultural developments, FOF 397, 406, and two
11 housing developments, both of which are only in the conceptual stage, FOF 385, 416.

12
13 **4. HC&S**

14 66. HC&S calculated that it used an average of 6828 gad, or 22.87 mgd on 3350 acres
15 of its Waihe`e-Hopoi Fields and 7716 gad, or 10.26 mgd on 1330 acres of its `Īao-
16 Waikapū Fields during 2004-2006. Excluding the 250 acres of Field 920 from the `Īao-
17 Waikapū Fields because it has consumed more water because of the porosity of its sandy
18 soil and its use for seed cane, there was an average use of 7098 gad on the remaining
19 1080 acres, or 7.67 mgd. FOF 436, 441, 443.

20 67. HC&S is able to satisfy the irrigation requirements for the `Īao-Waikapū Fields
21 more consistently, because the available water for these fields per acre is greater than it is
22 for the Waihe`e-Hopoi Fields. FOF 444.

23 68. For the Waihe`e-Hopoi Fields, the fields are typically at a substantial moisture
24 deficit during the summer months, when solar radiation is greater and ditch flows are low.
25 FOF 436

26 69. The rates reported in gad (gallons per acre per day) were not based on meter
27 readings. HC&S does not regularly calculate and use gad in managing its operations,
28 because averages can misstate actual irrigation requirements. FOF 437. Usage is
29 computed through its water balance database, determining how many irrigation hours
30 were charged to the fields and then multiplying by the application rate. FOF 438.

31 Furthermore, the irrigated acres could fluctuate yearly, because acres could be added that

1 were not in production previously and may take in more lands as HC&S surveys field
2 boundaries to determine the actual boundaries of its fields. FOF 439.

3 70. HC&S's computerized water balance model essentially calculates a water budget
4 that accounts for "deposits" of water in the form of rainfall and irrigation and
5 "withdrawals" in the form of evapo-transpiration, which is defined as the loss of water
6 from the soil both by evaporation and by transpiration from the plants growing in the soil.
7 The evapo-transpiration rate varies during the year, depending on weather conditions,
8 solar insolation, temperatures, humidity, and wind speed. In order to maintain sugar
9 yields, the sum of available rainfall plus irrigation water applied to the fields must
10 approach the evapo-transpiration rate to promote efficient growth. The evapo-
11 transpiration rate tends to be the highest during the months of May through September,
12 which are the peak growing periods. Adequately meeting evapo-transpiration rates is
13 directly correlated with crop yield potential. The model is used as a managerial tool to
14 decide what fields need to be irrigated and also tracks what is applied to the fields. FOF
15 451-452.

16 71. Fares also calculated irrigation requirements using a computerized water budget
17 model, FOF 454-463, which, in the opinion of HC&S's experts, was similar to HC&S's
18 model although different in significant respects. FOF 468-475, 486.

19 72. Fares's model accounts for water going into the plantation system and water
20 leaving the system as evapo-transpiration, overflow, runoff, excess due to drainage, and
21 the storage capability of the soil. The purpose of the model is to calculate the irrigation
22 requirements to keep the soil moisture level above the allowable water deficit, which is a
23 given percent of the soil moisture level at which the sugarcane plant wilts and can no
24 longer take water from the soil. His model assumes that the allowable water deficit is 65
25 percent of the available soil water holding capacity. FOF 455.

26 73. Fares's model is not intended to determine how much irrigation water to apply on
27 a daily basis. FOF 455.

28 74. Fares used an 80 percent probability for satisfying the crop's irrigation
29 requirements—that water sufficient to meet the irrigation requirements would be
30 available four out of five days—because it is the industry standard for calculating crop
31 water duties in both the government and private sectors. FOF 457. This was not

1 specifically identified by HC&S's expert witnesses as one of the factors that were
2 different in HC&S's model, but HC&S uses real-time data in its model to identify daily
3 irrigation requirements, not the average over a period of time. FOF 469.

4 75. Fares estimated that 5,674 gad would have satisfied the irrigation requirements for
5 the Waihe'e-Hopoi Fields in 80 percent of the 54 years of rainfall data up to 2004 that
6 was incorporated into his model, and that the comparable requirement for the 'Īao-
7 Waikapū Fields was 5,150 gad. FOF 464-465. For the latter fields, when Field 920 is
8 excluded, irrigation requirements would be 5,026 gad, and for Field 920, 5,752 gad. FOF
9 466-467. **Compare to** HC&S's 6,828 gad for its Waihe'e-Hopoi Fields and 7,716 gad
10 for its 'Īao-Waikapū Fields including Field 920 and 7,098 gad when Field 920 is
11 excluded, during 2004-2006. COL 66, *supra*, FOF 436, 441. HC&S's numbers are based
12 on acres irrigated during the time period (2004-2006), which are determined by how
13 many irrigation hours were charged to the fields and then multiplying by the application
14 rate, COL 68, *supra*, FOF 438. In other words, HC&S's numbers are the actual irrigation
15 rates, which were determined through its water balance model that calculates what the
16 water requirements were for the days that those irrigation rates were applied, modified by
17 the amounts of water that were actually available for irrigation. COL 67-68, *supra*.

18 76. Fares concluded that the only difference that results in his model calculating
19 lower irrigation requirements than HC&S's is his choice of irrigation efficiency of 85
20 percent versus HC&S's 80 percent. FOF 488-489. Fares defined irrigation efficiency as
21 the percentage of water that will be delivered to the plant. Thus, an irrigation efficiency
22 of 85 percent assumes that of 100 gallons pumped into the drip irrigation lines, 85 gallons
23 will be delivered to the plant. FOF 473.

24 77. Fares chose 85 percent irrigation efficiency because he concluded that it is the
25 irrigation standard and the minimum efficiency for which drip irrigation systems are
26 designed. FOF 488.

27 78. HC&S's witnesses agreed that HC&S's 80 percent efficiency assumption had
28 been used since before either of them started with HC&S; neither was aware of any
29 actual measurements or studies conducted by HC&S to verify the assumption. FOF 489.

30 79. However, HC&S's witnesses concluded that Fares's model and the
31 generalizations drawn from it do not necessarily track actual conditions and practices in

1 HC&S's West Maui Fields. FOF 477. For example: Fares's model: 1) does not account
2 for water that must be run through the irrigation system to detect leaks, FOF 477; 2) fails
3 to account for irrigation water "lost" because it is applied just before it rains, FOF 477;
4 and 3) assumes it is always practical for a sugarcane grower to apply irrigation water to a
5 field to restore its soil moisture storage level to 100 percent once it depletes to 65 percent,
6 when in practice irrigation water may not necessarily be available at the point the soil
7 moisture level reaches 65 percent, FOF 478. Furthermore, a round of irrigation can
8 consist of anywhere from 24 hours up to 72 hours of continuous irrigation. And at any
9 given time, only a fraction of the fields are actually receiving water. FOF 448. HC&S
10 also will deviate from its water balance model as dictated by field conditions and other
11 practical requirements. For example, HC&S does not rely strictly on the crop coefficient
12 in the initial phase of growth; when a field is first planted, the primary objective is to
13 keep the seed piece moist as to ensure germination. FOF 480. Water also needs to be
14 applied constantly in the initial stage of growth to keep away the lesser cornstalk borer
15 from boring into the shoots. FOF 480. Other reasons for applying water to the fields
16 besides replacing moisture lost to evapotranspiration include application of fertilizers and
17 herbicides. FOF 480.

18 80. These differences between the use of historical data versus day-to-day
19 measurements adjusted to field-level management and use of water could account for the
20 difference between Fares's and HC&S's estimates of irrigation requirements.

21 81. However, the evidence provided by HC&S of its actual water requirements, as
22 opposed to its water use, was not from the water balance model. "Historical daily
23 requirement" was calculated by replacing the historical evaporation rate, which assumed
24 that all of the water lost through evapotranspiration must be replaced by irrigation. FOF
25 490-492. However, even HC&S's own calculation of irrigation requirements subtracts
26 rainfall and multiplies the pan evaporation rate by a crop coefficient that varies from 0.4
27 to 1.0. HC&S's expert witness also testified that it also waters little or none at all during
28 the last six months before harvest. FOF 471, 484. Thus, the water "requirements"
29 provided by HC&S do not even correspond with its own stated process for calculating its
30 irrigation requirements.

1 82. Both HC&S and Fares use essentially the same model to estimate irrigation
2 requirements, with the principal differences being: 1) the absence of a pan coefficient in
3 HC&S's model, while Fares used a pan coefficient of 0.8; 2) a crop coefficient of 0.4 to
4 1.0 for HC&S and 0.4 to 1.25 for Fares; 3) an irrigation efficiency of 80% for HC&S and
5 85% for Fares; and 4) adjustments by HC&S of its calculations to account for field
6 conditions and other management actions. FOF 448-489. In the absence of HC&S
7 providing irrigation requirements based on the method it uses, the application of the
8 model by Fares is the only starting point available for determining actual irrigation
9 requirements. But the burden is on HC&S to avoid the model as the default requirement.
10 HC&S has met that burden in part by describing why its actual irrigation rates would be
11 higher than estimated by the use of the model, but HC&S has not taken the next step of
12 providing what its reasonable irrigation requirements would be for its Waihe'e-Hopoi and
13 'Īao-Waikapū Fields.

14 83. Fares's ascribed the greatest difference between his and HC&S's application of
15 the water balance model to his use of a 85 percent irrigation efficiency versus HC&S's 80
16 percent. Fares chose 85% because it is the irrigation industry standard and the minimum
17 efficiency for which drip irrigation systems are designed. FOF 488. On the other hand,
18 HC&S uses a 80 percent efficiency because it was the number inherited by the present
19 HC&S managers and had been in use before either of them started with HC&S. Neither
20 was aware of any actual measurements or studies conducted by HC&S to verify the
21 assumption. FOF 489. Therefore, the Commission accepts Fares's use of 85% as the
22 irrigation efficiency.¹

23 84. Both Fares and HC&S apply a crop coefficient of 0.4 in the initial stages of
24 growth, which lasts about two months. Fares uses a pan coefficient of 0.8, which HC&S
25 does not use. So the pan evaporation rate is multiplied by 0.4 by HC&S and 0.32
26 (0.8x0.4) by Fares. FOF 470-471.

27 85. During the last six months of the growing cycle, HC&S uses very little water in
28 the ripening stages and no water at all during the drying stage, which covers the last 40 to
29 60 days. In contrast, Fares's method decreases the irrigation linearly for the six months

¹ For example, at an application rate of 5000 gad, 85% efficiency means that 4250 gad reaches the plant, whereas with a 80% efficiency, 4000 gad reaches the plant. For the same amount of water to reach the plant as with 85% efficiency, 5312 gad would have to be applied, an increase of 6.24 percent.

1 before harvest and would continue to apply water during drying. Fares's crop coefficient
2 during this period decreases from 1.25 to 0.75 on the last day before harvest. Multiplied
3 by a pan coefficient of 0.8, during the last six months of a crop cycle, Fares' model would
4 apply 1.0 of the pan evaporation rate, decreasing to 0.6 at the last day before harvest. In
5 contrast, HC&S would be applying little or no water during this time. FOF 484.

6 86. During the peak growth period between establishment of the seed cane in the first
7 two months and preparation for harvesting during the last six months, or for about 16
8 months of the two-year crop cycle, HC&S would be replacing all evaporation losses
9 (minus rainfall), because of its use of a crop coefficient of 1.0 during this period and no
10 pan coefficient. Fares would also replace 1.0 of the evaporation losses (minus rainfall),
11 because of his use of a pan coefficient of 0.8 and a crop coefficient of 1.25 during this
12 period. FOF 484.

13 87. HC&S's application of the model results in 0.4 times the evaporation rate versus
14 Fares's 0.32 during the first two months. During the last six months, Fares's model
15 calculates requirements beginning at 1.0 times the evaporation rate, decreasing linearly to
16 0.6 at the end, or an average of about 0.8 times the evaporation rate, versus little or no
17 water used by HC&S. During the intervening 16 months, the peak growing season, both
18 HC&S and Fares calculates the same requirements, or 1.0 times the evaporation rate.
19 COL 87, *supra*. If we take the requirements on a monthly basis, both HC&S and Fares
20 would multiply the evaporation rate by 1.0 for sixteen months, by 0.4 for HC&S and 0.32
21 for Fares for two months, and by an average of 0.8 by Fares for six months. Summing
22 these totals over 24 months, the ratio would be 21.44 for Fares and 16.8 for HC&S, or
23 about 28% higher for Fares over HC&S. However, evaporation rates would vary across
24 the 24-month period, so the 28% higher rate for Fares is only an approximation.

25 88. Fares's irrigation requirements includes Field 920 for the 'Iao-Waikapū Fields,
26 with an 80% probability of 5150 gad. Without Field 920, the 80% probability would have
27 been 5026 gad, or about two percent less. FOF 465-467.

28 89. Thus, Fares requirements estimates could be as much as 30 percent higher than
29 what HC&S would have calculated if HC&S had used an efficiency factor of 85% instead
30 of 80%. Fares concluded that the only difference that results in his model calculating
31 lower optimal irrigation requirements than HC&S is the choice of irrigation efficiency,

1 FOF 488; but his use of water in the last six months contrasts sharply with HC&S's
2 testimony that little or no water was used in their actual field operations during this
3 period, FOF 484. Moreover, HC&S did not provide evidence that its calculations resulted
4 in higher requirements than Fares's. Instead, HC&S only provided calculations based on
5 replacing average evaporation rates for its Waihe'e-Hopoi Fields and provided no
6 calculations at all for its 'Iao-Waikapū Fields, FOF 490-493, and these estimates matched
7 nearly exactly its calculations for actual use. Compare FOF 436 with FOF 491.
8 Nevertheless, Fares would only say that, under his model, the optimal irrigation
9 requirements are less than what HC&S actually used. FOF 482.

10 90. HC&S testified to a number of plausible and reasonable factors that would
11 significantly increase their actual irrigation requirements over the quantities calculated
12 through application of the model that both HC&S and Fares used. FOF 477-480. COL 79,
13 *supra*. Fares's estimate of the 80% probability versus actual use by HC&S on its fields
14 were 5674 gad versus 6828 gad for the Waihe'e-Hopoi Fields, and 5150 gad versus 7098
15 gad for the 'Iao-Waikapū Fields. Compared to Fares's estimates, HC&S's use on the
16 Waihe'e-Hopoi Fields were 20% higher, while for the 'Iao-Waikapū Fields, use was
17 38% higher.

18 91. Taking into consideration the factors identified and discussed in the previous
19 COLs, a reasonable estimate of HC&S's irrigation requirements would be an increase of
20 5 percent over Fares's estimates. The 5 percent increase also applies to the 'Iao-Waikapū
21 Fields. Taking Fares's estimate of the 80 percent probability to satisfy crop irrigation
22 requirements, or 5674 gad for the Waihe'e-Hopoi fields and 5150 gad for the 'Iao-
23 Waikapū fields, an increase of 5 percent would be 5958 gad for the Waihe'e-Hopoi fields
24 and 5408 gad for the 'Iao-Waikapū fields. This 5 percent increase has been applied to all
25 of Fares's range of estimates from minimum to maximum requirements. Tables 10 and 11.

26 92. Thus, the Waihe'e-Hopoi Fields' water use requirements in 2004-2006 would
27 have been 5958 gad or 19.96 mgd for 3350 irrigated acres, versus the actual use of 6828
28 gad or 22.87 mgd. FOF 436. However, the 300 acres previously irrigated with wastewater
29 from MLP, which has ceased operations, FOF 261, must now be irrigated with stream
30 waters. Thus, water requirements for 3650 acres would be 21.75 mgd.

1 93. The `Iao-Waikapū Fields’s water use requirements in 2004-2006 would have been
2 5408 gad or 5.84 mgd for 1080 irrigated acres (excluding Field 920’s 250 acres), versus
3 the actual use of 7,098 gad or 7.67 mgd. FOF 443. However, an additional 40 acres has
4 been added. FOF 310, 311, 430. Thus, water requirements for 1120 acres would be 6.06
5 mgd.

6
7 **D. ALTERNATIVE WATER RESOURCES**

8 An alternative is practicable if it is available and capable of being used after
9 taking into consideration cost, existing technology, and logistics. COL 31.

10
11 **1. Kuleana Lands and MCLT**

12
13 **a. Kuleana Lands**

14 94. Appurtenant rights are preserved, COL 23, *supra*, and water use permits must be
15 issued, subject to that use being reasonable-beneficial and limitations imposed in the
16 event of a water shortage. COL 23-26, *supra*. The Code’s definition of “reasonable-
17 beneficial” does not include an explicit requirement that there are no practical alternative
18 water sources, COL 8, *supra*, but the Court has stated that the use of alternative water
19 sources is “intrinsic to the public trust, the statutory instream-use protection scheme, and
20 the definition of ‘reasonable-beneficial’ use.” COL 37, *supra*. The Commission resolves
21 this conflict in favor of not requiring appurtenant rights-holders to meet the practical
22 alternatives test, because the Hawai`i Constitution and the State Water Code expressly
23 preserves access to the specific surface waters that appurtenant lands historically and
24 culturally had. COL 23, *supra*.

25
26 **b. MCLT**

27 95. MCLT requests a diversion of 1.5 to 2.5 mgd, an amount it estimates as less than
28 25 percent of the likely historical `auwai flow to restore 27 acres of wetlands. FOF 304,
29 345.

30 96. A practical alternative source is the basal aquifer underlying the wetlands. FOF
31 353.

1 **2. MDWS**

2 97. MDWS has WUPAs for Kepaniwai Well and `Īao Tunnel to supply a total of
3 2.401 mgd, FOF 8, 363; and an agreement with WWC to receive up to 3.2 mgd of surface
4 water from the `Īao-Waikapū Ditch. FOF 239, 368.

5 98. All of MDWS's sources, including the eight `Īao basal aquifer sources previously
6 granted water use permits, are part of its integrated Central Maui System. FOF 362.

7 99. MDWS has considered various other sources in the Waihe`e, Kahakuloa, and
8 Waikapū aquifers, but those sources have not been show to be practical. FOF 370-371.
9 MDWS has also entered into a consent decree that restricts its ability to utilize water
10 sources from East Maui. FOF 372-373.

11
12 **3. WWC Delivery Agreements**

13 100. Information was provided at the CCH on only some of the Delivery Agreements.
14 FOF 378-416.

15 101. Some of the WWC contractees were also using or may have access to MDWS
16 water. FOF 401-403, 405, 410.

17 102. Wells, FOF 411, and recycled water, FOF 386, are possible but unexplored
18 alternatives.

19 **4. HC&S**

20 103. Well No. 7 was the primary source of irrigation water for the Waihe`e-Hopoi
21 Fields, averaging about 21 mgd between 1927 and 1985, FOF 494-495, and as recently as
22 June through November 1996 and May through October 2000, an average of 25 mgd and
23 18.9 mgd, respectively, was pumped, FOF 495. In the 1980s HC&S installed drip
24 irrigation in its field to increase the efficiency of water delivery to the plants, as did
25 WWC in the 1980s. FOF 215, 445. Each of the two pumps at water level can pump 17.5
26 mgd each to ground level and reach approximately 800 acres of the 3,650 acres of the
27 Waihe`e-Hopoi Fields, FOF 429, 496, and the booster pump at ground level can pump 14
28 mgd to the Waihe`e Ditch, from where it can reach all of the Fields except for the 175-
29 acre Field 715. FOF 496.

30 104. HC&S states that as currently configured, Well No 7 can supply only 14 mgd to
31 the Waihe`e-Hopoi Fields, with the exception of Field 715, FOF 497, but 14 mgd refers

1 only to the booster pump at ground level, while the two pumps at water level can pump
2 up to 17.5 mgd each to ground level, from which approximately 800 acres of the
3 Waihe`e-Hopoi Fields can be watered. COL 103, *supra*.

4 105. HC&S estimates that it would cost approximately \$525,000 to add another
5 booster pump and additional distribution pipeline to increase the volume that can be
6 pumped into the Waihe`e Ditch from 14 mgd to 28 mgd, with the cost of an additional
7 pipeline to reach Field 715 estimated at \$475,000. FOF 498.

8 106. HC&S further states that it does not have adequate electrical power to run the
9 pumps for Well No. 7 on a consistent and sustained basis because of its power contract
10 with MECO, FOF 499, and that increased pumping would exacerbate the degree to which
11 the sustainable yield is already being exceeded and reduce the recharge from imported
12 surface water that sustains the aquifer. FOF 500.

13 107. **Recycled County Wastewater** include at least 5 mgd from Maui County's
14 Wailuku/Kahului wastewater treatment plant, which is currently disposed of via
15 underground injection; and several hundred thousand gallons a day are also produced by
16 private treatment plants in Ma`alaea but unused and disposed of. FOF 501.

17 108. The County currently has no existing infrastructure to deliver recycled wastewater
18 to HC&S's fields, FOF 502; but private parties could construct their own pipeline to the
19 plant, FOF 504.

20 109. **Recycled Wastewater from HC&S's Puunene Mill** were or are still being used
21 to irrigate with an overhead sprinkler system on Fields 710-715. FOF 505.

22 110. **Recycled Wastewater from MLP** was used to irrigate Fields 921 and 922, which
23 was pasture at the time. They are currently irrigated with surface water for cane. This
24 source is no longer available, as MLP has ceased operations. FOF 261, 506.

25
26
27 **E. LOSSES**

28 Offstream users have the burden to prove that any system losses are reasonable-
29 beneficial by establishing the lack of practicable mitigation measures, including repairs,
30 maintenance, and lining of ditches and reservoirs. COL 35.

1 Whether or not a permit is required for system losses, offstream users, and
2 ultimately the Commission, must account for water lost or missing by adopting
3 provisions that encourage system repairs and limit losses. COL 36.

4
5 **1. Kuleana Lands**

6
7 **a. Kuleana Ditches**

8 111. Many of the ditches have readily observable leaks, including the kuleana ditches.
9 FOF 336. Furthermore, even at estimated inflow rates of 150,000 gad, kuleana users who
10 testified at the CCH complained of inadequate water, FOF 296, 335. WWC measures the
11 amount of water it delivers to each of the kuleana ditch/pipe system, FOF 222; but WWC
12 does not measure amounts of water delivered to or collect data on the individual users
13 from kuleana systems on a parcel-by-parcel basis, FOF 228. Thus, the kuleana ditches
14 must be leaking to such an extent that water is inefficiently being delivered to the
15 kuleanas.

16 112. WWC states that in the 1980s, it replaced ditches with pipes to make deliveries
17 more reliable and consistent, FOF 215, but evidence on the extent of that replacement is
18 lacking.

19 113. Even if access to stream water through an `auwai is part of the customary
20 Hawaiian practice of growing kalo on kuleana lands under Haw. Rev. Stat. § 1-1,
21 Reppun, 65 Haw. at 539, 656 P.2d at 63, if practicable measures are available to prevent
22 or minimize waste of the surface water resource, they should be utilized. While resource
23 preservation and traditional and customary Hawaiian practices are both trust purposes,
24 COL 13, *supra*, there is no categorical imperative or absolute priorities among trust
25 purposes, COL 14, *supra*. The purpose for transporting stream waters to kuleana lands for
26 appurtenant uses, whether for traditional and customary Hawaiian practices or for other
27 reasonable-beneficial uses, will still be achieved through practical, more efficient
28 methods such as enclosed pipes instead of open and unlined `auwai. Thus, in order to
29 prevent or minimize waste, kuleana ditches should be lined or enclosed pipes used in
30 their place, absent a showing that it is unnecessary to prevent waste, or that it is not
31 practical to do so.

1 **b. Kalo Lo`i**

2 114. Water “consumption” by kalo lo`i equals about 15,000 to 40,000 gad, FOF 300,
3 and consists of evaporation from open water, transpiration through the kalo leaves, and
4 percolation through the lo`i bottom and sides, and most of the loss is likely through
5 leakage and minimally through evaporation and transpiration. FOF 339.

6 115. A typical solution for percolation/leakage losses through standing bodies of water
7 such as reservoirs is to line the bottoms and sides with concrete or high-density
8 polyethylene. FOF 425. However, such a “solution” for leakage from kalo lo`i would
9 most likely be impractical; more importantly, it would be inimical to the very tradition
10 and custom of wetland kalo and its place in the tradition and culture of Hawaiians, FOF
11 61-62.

12 116. Therefore, for losses through leakages from kalo lo`i as opposed to leakages from
13 the ditches, the Commission recognizes such losses as part of the water duty for growing
14 wetland kalo.

15
16 **c. Outflows From Kalo Lo`i**

17 117. Water must be provided for consumptive and flow-through for wetland kalo, but
18 there will be large amounts of waste if outflows are not returned downstream of the
19 diversions, and disruption of stream flows in the stretches between the diversion and
20 return points.

21 118. Water for kalo lo`i is a noninstream use, COL 6, *supra*, and must show a lack of
22 practicable mitigating measures for losses, COL 35. In the WUPA process for kalo lo`i,
23 outflow waters will have to be returned to the stream, absent a showing that it is not
24 practicable to do so. If it is not practicable, the Commission may adopt provisions to limit
25 losses, including invoking its powers under the shortage provisions of the Code.

26 119. Another consequence of inflow/outflows in excess of consumptive requirements
27 is the “de-watering” of stream stretches between the diversion points and return points
28 further downstream, even if all or most of the lo`i outflows can practicably be returned to
29 the stream. To the extent practicable, those stretches should not be allowed to go dry,
30 and the WUPA process will have to address these circumstances.

31

1 **2. WWC**

2 120. The great majority of WWC’s ditches are unlined, as are all of its reservoirs; and
3 estimated losses from its ditch system are a set percentage of 7.34 percent. FOF 374-375.

4 121. WWC may in the future have plans to line the unlined portions of its system. FOF
5 376. Therefore, WWC has not established the lack of practicable mitigating measures to
6 address these losses.

7
8 **3. HC&S**

9 122. HC&S estimates that it loses 6-8 mgd through seepage from the Waiale Reservoir,
10 depending on the level of the reservoir, and estimates seepage throughout the rest of its
11 ditch and reservoir system at 3-4 mgd. FOF 423.

12 123. HC&S has not undertaken studies nor estimated the costs to line Waiale Reservoir
13 or the other reservoirs and ditches. FOF 425. Therefore, WWC has not established the
14 lack of practicable mitigating measures to address these losses.

15
16 **F. ECONOMIC IMPACT OF RESTRICTING NON-INSTREAM USES**

17 124. Current and potential non-instream users include all users of diverted stream
18 waters: 1) kuleana landowners and MCLT, who seek restoration to benefit their lands; 2)
19 MDWS, who favors stream restoration while also preserving and even expanding its use
20 of stream waters; 3) WWC’s Water Delivery customers; 4) WWC itself, which uses no
21 water directly but is in the business of delivering stream waters to non-instream users;
22 and 5) HC&S, the major user. FOF 507.

23 125. No information was presented at the CCH concerning the positive economic
24 impact on kuleana landowners and MCLT, although general testimony was presented on
25 the kinds of crops and activities they would be able to engage in if they were to receive
26 more stream waters. FOF 508.

27 126. Information on MDWS focused on the role of stream waters as part of its
28 integrated water supply system and the benefits to its public users. FOF 509.

29 127. Information was presented on some of WWC’s Water Delivery customers’ water
30 uses, which included the availability of MDWS water for at least some of them, FOF 510,

1 and some information was presented on WWC's water delivery charges, which
2 presumably would be impacted if stream diversions were to be reduced. FOF 511.

3
4 **1. WWC**

5 128. WWC charges between \$0.20 and \$2.40 per thousand gallons delivered, and the
6 contracts introduced into evidence indicate that most of its customers pay a rate
7 equivalent to the county rate for agricultural water of about \$0.85 to \$0.90 per thousand
8 gallons. FOF 512-513.

9 129. However, many of WWC's water-delivery contracts do not involve any actual
10 present use but allow WWC to collect a minimum charge, regardless of any use, based on
11 a percentage of the stipulated maximum delivery. FOF 514. WWC has water-delivery
12 agreements with 34 entities (in addition to MDWS and HC&S). FOF 240.

13 130. The maximum delivery agreements that WWC has with these 34 entities total
14 8.288 mgd, and the amount of water actually used under these agreements was 1.42 mgd
15 in 2005 and 2.37 mgd in 2006. FOF 257-258. At the rate of \$.85 to \$0.90 per thousand
16 gallons, WWC's income from the delivery agreements would have been \$1,207 to \$1,278
17 per day in 2005 and \$2,015 to \$2,133 per day in 2006. Income from the minimum charge
18 would be additional but was not available.

19 131. In a filing with the state Public Utilities Commission ("PUC"), WWC proposed a
20 tariff rate of \$0.90 per thousand gallons, with a 10 percent profit rate. The PUC-approved
21 rate would negate pre-existing rate contracts. FOF 516-517. At \$0.90 per thousand
22 gallons, WWC would have had income from the 1.42 mgd it delivered to its contractees
23 in 2005 of \$1,278 per day and in 2006 of \$2,133 per day, with a profit rate of about \$128
24 per day in 2005 and \$213 in 2006.

25 132. WWC also receives an unspecified delivery fee from MDWS for the amount
26 taken in excess of 1.074 mgd from its and MDWS's 'Īao Tunnel (Well No 5332-02).
27 FOF 518. However, the source of this water is high-level diked ground water and would
28 not be affected by any reduction in diversion of stream waters.

29 133. WWC and MDWS also had an agreement allowing MDWS to receive up to 3.2
30 mgd from the 'Īao-Waikapū Ditch which expired in 2008 but which apparently continues,
31 under which there may be a fixed transportation fee of \$0.48 per thousand gallons. FOF

1 519. This agreement could be affected by an amended IIFS for `Īao Stream even though
2 the flow above the diversion would not be affected, because the amended IIFS may
3 reduce WWC's ability to divert stream waters at its `Īao Ditch diversion and change the
4 conditions under which WWC and MDWS entered into their agreement.

5 134. WWC does not charge kuleana users for deliveries. FOF 520. If WWC ceases to
6 provide water through its system and kuleana landowners want to continue their use,
7 they would have to prove that they have easements accompanying their appurtenant
8 rights (which also has to be recognized by the Commission) on the lands underlying
9 WWC's ditch system.

10 135. HC&S pays WWC a flat fee for water used on the `Īao-Waikapū Fields, which
11 was \$300/acre/year in 2005. FOF 520. For the 1,330 acres irrigated in 2005, the fee
12 would have been \$399,000.

13 136. WWC also provides irrigation water to HC&S to its Waihe`e-Hopoi Fields, which
14 are watered from HC&S's Waiale Reservoir. About half of the total amount is delivered
15 to Waiale Reservoir from the Waihe`e Ditch through the Hopoi Chute, and about half
16 from the Spreckels Ditch. However, the Spreckels Ditch also carries water from HC&S's
17 diversions and tunnel, FOF 268-285, so it is difficult to identify how much comes from
18 WWC's system. Even for water delivered by WWC from the Waihe`e Ditch, the amounts
19 are not based on meter readings; instead, WWC calculates the number of gallons
20 delivered to users other than HC&S and then attributes the balance to HC&S. FOF 288.
21 HC&S's use of water from WWC's system traces back to 1924, when water from
22 Waihe`e Stream was shared between Brewer and HC&S. After 1988, when Brewer no
23 longer needed the Waihe`e Stream downstream of the Hopoi chute, WWC has generally
24 left the gate open and the water formerly used by Brewer has flowed down into the
25 Waiale Reservoir. FOF 273. No evidence was introduced that WWC charges HC&S for
26 this water.

27 **2. HC&S**

28 137. HC&S stated that a key factor in HC&S' ability to sustain itself is the economies
29 of scale it can apply to the approximately 35,000 contiguous acres it cultivates on Maui,
30 of which the West Maui Fields comprise about 5,300 acres. If reductions in HC&S's use
31 of stream waters were of such a magnitude as to force HC&S not to cultivate the 5,300

1 acres that comprise its West Maui fields, HC&S would not be a viable plantation. FOF
2 523, 533. The West Maui Fields provide the most productive yields of all of HC&S's
3 cultivated lands, making the West Maui Fields critical to the viability of HC&S. In 2006,
4 HC&S grew 81 percent of Hawai'i's raw cane sugar crop. FOF 524-525.

5 138. HC&S employs about 800 full-time workers and EMI employs about 17 workers
6 on Maui. FOF 526. The immediate impacts would include lost jobs and in excess of \$100
7 million of spending on Maui, generating approximately \$250,000,000 annually to the
8 County of Maui and State of Hawai'i economies. Closure of HC&S would have a
9 deleterious effect on efforts to promote agriculture and curb urbanization in Hawai'i. The
10 withdrawal of HC&S's 35,000 acres of prime agricultural lands from sugar would vastly
11 increase the agricultural lands in the State and on Maui that would be idle. Past
12 experience with closure of other plantations has demonstrated the difficulty of returning
13 former plantation lands into agriculture, especially if reliable access to irrigation water is
14 curtailed. This increases the pressure to urbanize these lands instead of keeping them in
15 agricultural use, and idling of HC&S's lands will also result in the deterioration of
16 existing irrigation systems and infrastructure that would be extremely expensive to
17 replace. FOF 527, 533.

18 139. Generally, remaining economically viable involves achieving targets in terms of
19 sugar yields and maintaining a reasonable cost structure. Small reductions of water for
20 irrigation on any given day might have little or no negative impact, depending on weather
21 conditions, location, and crop cycle. Larger, persistent reductions, with no corresponding
22 mitigation of impacts, especially if combined with reductions in the amounts that HC&S
23 will be permitted to continue to divert in East Maui, will likely render HC&S unviable.
24 FOF 534.

25 140. HC&S' sustainability is to some extent a result on its ability to spread its fixed
26 costs of mill and related facilities operations over the revenues generated from farming
27 the extensive acreage. One method of spreading costs is to generate revenues from the
28 by-products of farming sugar cane and production of raw sugar. One revenue source,
29 energy sales, comes from the burning of bagasse, a by-product of sugar cane production,
30 and from hydro power, a by-product of operation of a water delivery system. HC&S's
31 business success depends on its ability to receive significant revenues from selling the

1 electric power it generates to Maui Electric Company under long term contracts.
2 Revenues from energy sales make up about 20 percent of the total revenues generated by
3 the agribusiness companies compared to about 5 percent of the total revenues from a
4 decade before. HC&S diversified its product line by increasing production of foodgrade
5 raw sugar, which returns a higher margin than commodity sugar. In the last four years,
6 HC&S made capital investments of up to \$20,000,000 supporting its efforts to diversify
7 product lines, reduce costs of production, and increase revenues from other sources. FOF
8 528-532.

9 141. The key agronomic driver in determining sugar production is per acre yields,
10 which is measured in tons of sugar per acre (“TSA”). HC&S has determined that, on a
11 long term basis, sustainable yields should be between 13 and 14 TSA per crop cycle,
12 which would translate into over 200,000 tons of sugar per year given the acreage that
13 HC&S has in cultivation. HC&S needs to achieve yields in this range to remain viable,
14 i.e., to generate sufficient revenues to carry its fixed and variable costs and return a
15 reasonable profit to its shareholders. One of the most important variables determining
16 yields is water. As a rule of thumb, HC&S needs to harvest about 400,000 acre-months
17 of cane growth per year to be viable. That translates into approximately 200,000 tons of
18 sugar. Reduction of water deliveries to Waiale Reservoir, especially during periods of
19 low ditch flows, will force HC&S to try to replace that water to the extent possible by
20 pumping water from Well No. 7 at the expense of pumping from other wells. However,
21 power limitations restrict the amount of water that HC&S can ultimately pump, which
22 affects sugar yields. FOF 535.

23 142. Prolonged drought conditions, such as HC&S has experienced for much of the
24 last 15 years, can cause a reduction in average crop age by delaying the replanting of
25 harvested fields and prompting the premature harvesting of fields whose growth potential
26 is compromised by lack of water. Disease and other operating conditions can also cause a
27 reduction in average crop age. In addition, during water-short periods, the cane does not
28 grow; hence the physical age of the cane is greater than the growth age. FOF 536. The
29 average crop age of harvested acres at HC&S has dropped from 2003 to 2006 due to the
30 combined effects of drought and HC&S’s 2001 closure of its Paia Mill, which was done
31 to reduce costs and increase efficiency by centralizing all sugar processing at the Puunene

1 Mill. In 2001, total acres harvested were approximately 2000 less than the prior year,
2 because the Puunene Mill was initially unable to absorb all of the lost capacity from the
3 Paia Mill closure. Harvesting fewer acres increased the average crop age of the
4 unharvested acres. As capacity was added to the Puunene Mill and HC&S gained more
5 experience in the reconfigured operation, harvested acres increased again, resulting in a
6 lower average crop age and lower yields. FOF 537. Given the currently reduced crop age
7 of HC&S' fields, HC&S expects to reduce its rate of harvesting into 2008 and 2009 to
8 allow for an increase in crop age so as to improve yields, and then return to harvesting at
9 its historic rate of approximately 16,000 to 17,000 acres per year that maximizes the
10 acreage that can be served with currently available irrigation water as well as the current
11 processing capacity of the Puunene Mill. The short-term result will be diminished
12 revenues both from reduced sugar production and reduced production of bagasse to fuel
13 the power plant. The hoped for longer term result will be increased yields which, together
14 with increased revenues from the production and sale of specialty sugars and further
15 expansion of energy related sales, will allow HC&S to remain economically viable. This
16 will be possible only if HC&S' continued access to irrigation water is not significantly
17 reduced. FOF 538.

18 143. Chan-Halbrendt, OHA's expert witness, was asked to evaluate the economic
19 analysis undertaken by HC&S, not perform an independent economic analysis of the
20 impact of stream water reductions to HC&S. She concluded that HC&S "provided no
21 economic analysis of the impacts of decreasing its use of Nā Wai `Ehā water," and "made
22 no apparent attempt to substantiate and quantify the impact, even though I believe many
23 of the essential data for such analysis are within HC&S's possession." FOF 539, 550.

24 144. As examples of unsubstantiated assumptions, Chan-Halbrendt provided the
25 following:

26 a. HC&S claimed that, in order to remain economically viable, it needed to
27 achieve a yield of 13 to 14 tons of sugar per acre ("TSA") on a sustainable, long-term
28 basis. The data from A&B's 10-K filings indicates that HC&S had obtained those yields
29 in only four of the fifteen years from 1992 to 2006, and that there was only a weak
30 correlation, if any, between the TSA and HC&S's profits. FOF 540.

31 b. HC&S claimed that it had "benefitted" from the acreage it leased in the

1 `Īao-Waikapū Fields and the additional Nā Wai `Ehā water it gained access to when
2 WWC's predecessor abandoned sugar cultivation. The data from A&B's 10-K filings
3 indicates that HC&S's raw sugar production was lower in the ten years after 1994, when
4 it leased the additional acreage in the `Īao-Waikapū Fields, than it was in the ten years
5 before, and the profitability of the agribusiness sector, of which HC&S is a part, actually
6 decreased after 1988, when HC&S gained access to the additional Nā Wai `Ehā stream
7 water. FOF 540.

8 c. HC&S claimed that maintaining the number of acres it has in sugar
9 cultivation is necessary to remain economically viable. A&B's 10-K filings, though,
10 indicate that, from 2000 through 2005, HC&S decreased its cultivated acreage by more
11 than 2000 acres, which increased only slightly in 2006. Moreover, A&B has development
12 plans that would remove almost 3,500 additional acres from cultivation. FOF 540.

13 d. HC&S has also claimed that its survival hinges on the `Īao-Waikapū
14 Fields and having sufficient Nā Wai `Ehā water to irrigate them, but it made no apparent
15 attempt to acquire those lands when they became available. HC&S had no written
16 agreement with WWC after July 2003, when WWC refused to extend the land lease and
17 announced HC&S was "no longer entitled to any water allocation pursuant to that
18 Temporary Water Agreement." This continued until July 2005 (after the IIFS petition
19 was filed), when Atherton et al. began acquiring the land and HC&S and WWC settled
20 on their present terms for water in a one-page letter. FOF 541.

21 145. In responses to these criticisms, HC&S stated that:

22 a. Financial information about the A&B Agribusiness Group reported in the
23 Form 10-K filings is meant only to provide a general view of the performance of the
24 group. The filings do not account for revenues not based directly on sugar production,
25 such as power sales to MECO. The filings also do not account for increased costs,
26 declines in sugar prices, the effects of disease and drought, the effects of federal disaster
27 relief payments received by HC&S for drought conditions, the inclusion of C&H in the
28 financial reports of the Agribusiness Group from 1993 through 1998, the addition of
29 specialty sugars sales in later years, and other factors that influence the profitability of
30 HC&S. Given HC&S's cost structure, which in 2008 totaled approximately \$104 million,

1 HC&S needs to generate revenue based on 13-14 TSA to remain viable going forward.
2 FOF 554.

3 b. Chan-Halbrendt did not focus on crop age and acres harvested. There is a
4 very high correlation between average crop age per acre harvested and TSA. All other
5 things being equal, the greater the age of the cane at the time of harvest, the greater the
6 yield and the resulting sugar revenues over which to spread the average cost of preparing,
7 planting, and harvesting each acre during a given two-year cycle as well as the fixed costs
8 of operating and maintaining HC&S' mill and other facilities. All other things being
9 equal, producing more sugar per acre harvested in turn results in more net sugar revenues,
10 and harvesting more acres results in the production and sale of more sugar. FOF 555.

11 146. In concluding that HC&S had not provided an economic analysis, Chan-
12 Halbrendt advised conducting a general equilibrium analysis and partial equilibrium
13 analysis. General equilibrium analysis analyzes how an industry affects other sectors'
14 economy, while partial equilibrium analysis analyzes the impact of changes on economic
15 performance on the industry itself. FOF 551.

16 147. Chan-Halbrendt was of the opinion that a partial equilibrium analysis could
17 examine the impact on HC&S's profitability under several scenarios, such as: use of
18 pumped ground water or conservation measures to compensate for incremental reductions
19 of Nā Wai `Ehā water; projected change in yield caused by varying increments of water
20 reduction; incremental shifts in cultivated acreage in response to incremental reduction in
21 available water; or a combination of such factors. FOF 548.

22 148. Chan-Halbrendt was of the opinion that the scenarios identified for analysis in a
23 partial equilibrium analysis are substantially the same as those identified by HC&S as
24 available options in the event its access to Nā Wai `Ehā is restricted. HC&S's estimate of
25 electrical costs of pumping Well No. 7, without any information about the costs or
26 benefits of the other options, might be a factor in an economic analysis, but does not
27 substitute for the analysis. HC&S has not analyzed the economic impact of increased
28 water costs on its business and has done no financial analysis of the impact of having to
29 pay for water at the agricultural rate that other farmers pay. FOF 549.

30 149. According to Chan-Halbrendt, to assess whether reducing the Nā Wai `Ehā water
31 available to HC&S on 15 percent of its cultivated acreage would have impacts that extend

1 to the economies of the County of Maui and the State of Hawai`i would require, initially,
2 a partial equilibrium analysis to determine the impacts on HC&S, which would then feed
3 into a general equilibrium analysis which would consider inter-sectoral, employment, and
4 income impacts and may include the economic values and opportunity costs of alternative
5 uses of water, including instream uses. Such an analysis, had HC&S performed one, may
6 potentially have revealed “not only a mitigation of adverse impact, but also an overall
7 increase in economic and social welfare” because, among other things, “reallocation of
8 water can facilitate its efficient and equitable distribution to higher valued uses, both
9 within agriculture as well as in other sectors.” FOF 542.

10 150. The Commission concludes that Chan-Halbrendt is substituting her approach to
11 economic analysis for the balancing test that the Commission must perform between
12 instream values and non-instream uses, because she includes instream uses among the
13 economic values and opportunity costs of alternative uses of water. This is confirmed by
14 her conclusion that “the lack of any economic analysis (i.e., a partial equilibrium analysis
15 that feeds into a general equilibrium analysis), or the data required to conduct such an
16 analysis, prevents anyone, including this Commission, from evaluating HC&S’s claims
17 of economic impact (*emphasis added*).” FOF 551.

18 151. The Commission’s duty in establishing the IIFS includes weighing the economic
19 impact of restricting non-instream uses. COL 4, *supra*. The law does not prescribe a
20 specific method for weighing that economic impact, and in insisting that the Commission
21 is prevented from evaluating HC&S’s claims of economic impact without following the
22 dictates of her preferred method, Chan-Halbrendt is expressing a legal opinion, an area
23 that is outside the realm of her qualifications as an expert witness.

24 152. As “the primary guardian of public rights under the trust,” this Commission “must
25 not relegate itself to the role of mere umpire passively calling balls and strikes for
26 adversaries appearing before it, but instead must take the initiative in considering,
27 protecting, and advancing public rights in the resource at every stage of the planning and
28 decisionmaking process.” Waiāhole I, 94 Haw. at 143, 9 P.3d at 455.

29 153. Analyses along the lines suggested by Chan-Halbrendt, COL 148, *supra*, would
30 have been helpful, but the lack of such analyses does not prohibit the Commission from
31 its duty of weighing instream values with non-instream uses.

1 154. Both HC&S and Chan-Halbrendt focused their analytical approach on the impact
2 on HC&S's total sugar operations over 35,000 acres, if the 5,000 acres of the West Maui
3 fields, 15 percent of the total, were shut down due to a lack of water. FOF 523, 533, 542.
4 COL 137, 149, *supra*. It would have been more helpful to the Commission if either or
5 both parties had provided information on incremental decreases in surface water to the
6 5,000 acres of HC&S's West Maui Fields. The issue before the Commission in this CCH
7 is a balancing of instream values and non-instream uses for the Nā Wai `Ehā waters and
8 not an all-or-nothing choice between the two. The Supreme Court has declined to elevate
9 any particular category of water use to the level of a "categorical imperative." Instead, the
10 Commission is to "weigh competing public and private water uses on a case-by-case
11 basis, according to any appropriate standards provided by law," and the Court has
12 "indicated a preference for accommodating both instream and offstream uses where
13 feasible." Waiahole I, 94 Haw. at 142, 9 P.3d at 454.

14
15 **G. INTERIM INSTREAM FLOW STANDARDS (IIFS)**

16
17 **1. Diversions and Stream Flows**

18 155. The current IIFS for the Nā Wai `Ehā streams are the flows that were in the
19 streams on December 10, 1988: "that amount of water flowing in each stream on the
20 effective date of this standard, and as that flow may naturally vary throughout the year
21 and from year to year without further amounts of water being diverted offstream through
22 new or expanded diversions, and under the stream conditions existing on the effective
23 date of the standard." HAR §13-169-48.

24 156. Gaining reaches of streams are those in which ground water contributes to the
25 streamflow by a breaching of the ground water system by the stream. Losing reaches of
26 streams are where the channel bottoms are above the water table and an unsaturated zone
27 exists between the stream and water table. In the upper reaches of the Nā Wai `Ehā area,
28 the stream channels intersect the dike-impounded ground waters, which results in a
29 contribution of ground water to the stream, making the streams gaining in the upper
30 reaches. In the lower reaches of the Nā Wai `Ehā area, the stream channels overlie the
31 basal freshwater lenses, allowing stream waters to migrate from the stream bed to the

1 basal lenses, making the streams losing in the lower reaches. At the mouths of the
2 streams in the Nā Wai `Ehā area, some of the stream channels intersect the basal
3 freshwater lenses, making those streams gaining in that area. The Nā Wai `Eha streams
4 are generally gaining streams above the existing diversions and losing streams below the
5 diversions. FOF 87-92.

6 157. For 1984-2005, USGS estimates the flow of Waihe`e River at 605 feet elevation,
7 upstream of all diversions (Waihe`e Ditch at 600 feet elevation and Spreckels Ditch at
8 400 feet elevation), to be: Q_{90} flow was 24 mgd, Q_{70} flow was 29 mgd; and Q_{50} flow was
9 34 mgd. The lowest minimum daily flow recorded was 14 mgd, occurring on only 6 days
10 over 22 years. Estimated stream flow losses in Waihe`e River downstream of the
11 Spreckels Ditch may range from 2.1 mgd to at least 5.9 mgd. Although actual losses may
12 vary as a function of streamflow, because data are limited, a constant loss of 4 mgd is
13 assumed by USGS. Waihe`e and Spreckels Ditches are capable of diverting all of the dry-
14 weather flow available at the intakes, but stream flow immediately downstream of the
15 intakes may exist because of leakage through or subsurface flow beneath the dams at
16 these sites. Estimated dry-weather flow immediately downstream of the Waihe`e and
17 Spreckels Ditch intakes commonly is on the order of about 0.1 mgd, but the stream may
18 not have continuous surface flow from mauka to makai. FOF 108-109, 111.

19 158. Low-flow characteristics for North Waiehu Stream during the 1984-2005 climate
20 years were estimated using record-extension techniques and available historical data
21 during 1911-1917. The minimum discharge (Q_{100}) measured at gaging station 16608000
22 at an altitude of 880 feet was 1.6 mgd during March 1915. The estimated Q_{90} discharge
23 ranges from 1.4 mgd to 2.7 mgd for 1984-2005; the estimated Q_{70} discharge ranges from
24 2.3 mgd to 2.7 mgd; and the estimated Q_{50} discharge ranges from 3.1 mgd to 3.6 mgd.
25 Water is diverted by the North Waiehu Ditch near an altitude of about 860 feet and
26 generally diverts most of the water available at the diversion structure, but leakage from
27 the North Waiehu Ditch may sometimes return to the stream. USGS estimates that North
28 Waiehu Stream loses 1.3 mgd between the North Waiehu Ditch and the confluence of
29 North and South Waiehu Streams. Low-flow characteristics for South Waiehu Stream the
30 1984-2005 climate years were estimated using record-extension techniques and available
31 historical data during 1911-1917 from discontinued USGS gaging station 16610000. The

1 minimum discharge (Q_{100}) measured at gaging station 16610000 at an altitude of 870 feet
2 was 1.5 mgd during July 1913. Near gaging station 16610000 at an altitude of 870 feet,
3 the estimated Q_{90} discharge ranges from 1.3 mgd to 2.0 mgd for 1984-2005; the estimated
4 Q_{70} discharge ranges from 1.9 mgd to 2.8 mgd; and the estimated Q_{50} discharge ranges
5 from 2.4 mgd to 4.2 mgd. Water is currently diverted from South Waiehu Stream by the
6 Spreckels Ditch and two kuleana ditches farther upstream. The main diversion is the
7 Spreckels Ditch, near an altitude of about 270 feet and about 1000 feet upstream from the
8 confluence of North and South Waiehu Streams. No information is available on estimated
9 losses in South Waiehu Stream, but USGS estimates that the loss in Waiehu Stream itself,
10 downstream of the confluence of North and South Waiehu Streams to the mouth of the
11 stream, is 0.6 mgd. Return flows and leakage from the kuleana ditches have been
12 observed entering South Waiehu Stream. In addition, overflow or releases from the
13 Waihe`e and Spreckels Ditches may sometimes enter South Waiehu Stream. Spreckels
14 Ditch is commonly capable of diverting all of the flow of South Waiehu Stream during
15 dry-weather conditions, although stream flow immediately downstream of the intake may
16 exist because of leakage through or subsurface flow beneath the dam at the intake.
17 Waiehu Stream is commonly dry farther downstream near Lower Waiehu Beach Road,
18 and therefore, Waiehu Stream does not flow continuously from mauka to makai. There is
19 extensive channel erosion below the Spreckels Ditch on South Waiehu Stream, with a 12-
20 foot drop in the elevation of the stream just below the diversion, and there is a vertical
21 concrete apron located just below the highway culverts in lower Waiehu Stream. FOF
22 113-114, 116, 119-124.

23 159. On the basis of 22 years of complete records (climate years 1984-2005) at USGS
24 stream-gaging station 16604500 on `Īao Stream near an altitude of about 780 feet and
25 above all diversions, the minimum daily mean flow (Q_{100}) was 7.1 mgd, occurring on 29
26 days over 22 years; the Q_{90} flow was 13 mgd; the Q_{70} flow was 18 mgd; and the Q_{50} flow
27 was 25 mgd. The two main diversions are `Īao-Waikapū and `Īao-Maniania Ditches near
28 an altitude of about 780 feet (there is also a small privately owned pipe farther
29 downstream), and the Spreckels Ditch, near an altitude of about 260 feet and about 2.4
30 miles downstream from the `Īao-Waikapū and `Īao-Maniania Ditches. The `Īao Flood
31 Control Project starts about 2.5 miles above the mouth of `Īao Stream and consists of a

1 debris basin, a concrete channel that runs from the debris basin to just downstream of
2 North Market Street, a 20-foot vertical drop, a broadened but unlined channel running to
3 Waiehu Beach Road, and concrete wing walls running about one-half of the distance
4 from the Waiehu Beach Road to the mouth of the stream. In 2008, a \$30 million project
5 was advertised to line the remaining Control Project channel and raise existing levees to
6 eliminate future flooding and levee failure. USGS estimates that `Īao Stream loses 6.3
7 mgd in reaches that are not lined with concrete and that are downstream of the `Īao-
8 Maniania Ditch diversion (which is at about 780 feet elevation), or 3.00 miles from about
9 595 feet elevation down to 35 feet elevation. Water that overflows or leaks from the ditch
10 systems or that is discharged through gates in the systems sometimes returns to `Īao
11 Stream downstream of the diversions. In the absence of ditch return flows and runoff
12 during and following periods of rainfall, `Īao Stream remains dry in some reaches
13 downstream of the main diversion intake for the `Īao-Maniania and `Īao-Waikapū
14 Ditches and does not flow continuously from mauka to makai. FOF 126-131.

15 160. On the basis of record extension techniques applied by USGS to the historical
16 data from Waikapū Stream near gaging station 16650000 near an altitude of about 880
17 feet, the estimated Q_{90} flow was from 3.3 mgd to 4.6 mgd during climate years 1984-
18 2005; the estimated Q_{70} flow was 3.9 mgd to 5.2 mgd, and the estimated Q_{50} flow ranged
19 from 4.8 mgd to 6.3 mgd. The lowest recorded flow was 3.3 mgd in October 1912. The
20 record extension techniques applied to the historical data to estimate the natural flow near
21 gaging station 16650000 combined 1910-1917 historical data from gaging station
22 16650000, flows in the South Side Waikapū Ditch near an altitude of about 1,120 feet,
23 and flows in the Everett Ditch near an altitude of about 900 feet. (Oki, WDT 9/14/07, ¶
24 27.) While the Everett Ditch is no longer active, the South Side Waikapū Ditch is. The
25 estimates of natural flow assume no gains, losses, or return flows between the South Side
26 Waikapū Ditch diversion and station 16650000 during the period when the gaging
27 stations were operated. Recent USGS seepage-run data from 2004 indicate no significant
28 net gain or loss between the South Side Waikapū Ditch diversion and station 16650000.
29 (Oki, WDT 9/14/07, ¶ 27.) Thus, the estimated natural flows just above the South Side
30 Waikapū Ditch diversion should be the same as those estimated at station 16650000.
31 Active diversions on Waikapū Stream include the South Side Waikapū Ditch near an

1 altitude of about 1,120 feet, an intake on the Waihe`e Ditch (elevation not specified), and
2 the Reservoir 6 Ditch (elevation not specified). Numerous return flows have been
3 observed in Waikapū Stream downstream of the diversions. Diversions in Waikapū
4 Stream may not cause the stream to be dry immediately downstream of the diversions,
5 although it is commonly dry downstream of all diversions because of infiltration losses
6 into the streambed, and the stream does not flow continuously from mauka to makai. FOF
7 133-137.

8 161. Stream flows in Hawai`i have decreased significantly over a 90-year period.
9 While USGS has not observed any significant trends in median flows in the Waihe`e
10 River over the period, 1984 to 2005, the climate years upon which the USGS Q flows are
11 based, average (or mean) monthly total stream flows for Waihe`e River for the three 8-
12 year periods 1984-1991, 1992-1999, and 2000-2007, decreased by about 25 percent. The
13 monthly flows averaged 1639.1 mgd, 1436.0 mgd, and 1236.6 mgd, and translate into
14 daily averages of 54.64 mgd for 1984-1991, 47.87 mgd for 1992-1999, and 41.22 mgd in
15 2000-2007. In the same periods, `Īao Stream flows decreased by about 10 percent. FOF
16 94-95. Waiehu and Waikapū Streams are not gaged, FOF 113, 119, 133, but it would be
17 reasonable to assume that the flows in those two streams have decreased by similar
18 amounts; i.e., between 10 to 25 percent over the three eight-year periods from 1984 to
19 2007.

20 162. If we average the daily flows for the three eight-year periods in COL 161, *supra*,
21 the average daily flow for Waihe`e River for 1984-2007 was 47.91 mgd, compared to the
22 average daily flow for 2000-2007 of 41.22 mgd. Although USGS did not detect any
23 significant trends in median flow (Q_{50}), the average flow in the years 2000-2007 was 86
24 percent of the average flow for the years 1984-2007. So even though USGS has
25 concluded that there were no significant trends of the Q_{50} flow of 34 mgd for Waihe`e
26 River, a decrease of 14 percent between the average flow from 1984-2007 versus from
27 2000-2007 means that there was less water in Waihe`e River for the last eight years of the
28 24-year period on which the USGS Q flows were calculated. This would also hold true
29 for `Īao Stream, although the decrease there was less, at 10 percent, and for Waiehu and
30 Waikapū Streams, although the extent of the decreases there are not known, because both
31 streams are not currently gauged.

1 163. WWC diverts: 1) from 70 to 90 percent of the annual total flow of Waihe`e River;
2 2) from 40 to 60 percent of the annual total flow of North Waiehu Stream; 3) from 30 to
3 50 percent of the annual total flow of `Īao Stream; and 4) from 60 to 80 percent of the
4 annual total flow of Waikapū Stream. FOF 210-213.

5 164. These diversions: 1) averaged 37.09 mgd in 2005 and 29.72 mgd in 2006 by
6 WWC for Waihe`e River; 2) averaged 1.41 mgd in 2005 and 1.38 mgd in 2006 by WWC
7 for North Waiehu Stream and ranged from a low of 2-3 mgd during dry periods to a
8 maximum of 10-15 mgd during wet periods by HC&S for South Waiehu Stream; 3)
9 averaged 13.68 mgd in 2005 and 13.53 mgd in 2006 by WWC and ranged from a low of
10 3-4 mgd during dry periods to a high of about 20 mgd during wet periods by HC&S for
11 `Īao Stream; and 4) averaged 4.32 mgd in 2005 and 4.31 mgd in 2006 by WWC for
12 Waikapū Stream. Table 8; FOF 210-212. These diversions, plus the three kuleana
13 diversions known to be present on South Waiehu, `Īao, and Waikapū Streams (See Table
14 1) divert all of the dry-weather flows of Waihe`e River and North and South Waiehu
15 Streams. FOF 111, 116, 124. `Īao Stream remains dry in some reaches downstream of the
16 diversions through a combination of diversions and infiltration losses into the stream bed,
17 FOF 129-131, and although diversions may not cause Waikapū Stream to be dry
18 immediately downstream of the diversions, it is commonly dry further downstream of all
19 diversions because of infiltration losses into the streambed. FOF 137.

20 165. Table 9 compares the gate capacities and settings and the quantities of diverted
21 waters for 2005 and 2006 with the Q₉₀, Q₇₀, and Q₅₀ flows. All of the diverted amounts
22 were less than the gate settings, except for Waikapū Stream, where the setting is at 3 mgd,
23 but more than 4 mgd were diverted in both 2005 and 2006. However, the amounts
24 diverted from Waikapū Stream are in the range between the Q₉₀ and Q₇₀ flows and
25 therefore divert all of the stream waters from 10 percent to about 30 percent of the time.
26 For Waihe`e River, the diverted amounts range from the Q₇₀ flows to more than the Q₅₀
27 flows and therefore divert all of the stream waters from 30 to more than 50 percent of the
28 time. For Waiehu Stream, the diverted amounts range between the Q₉₀ and Q₇₀ flows and
29 therefore divert all of the stream waters from 10 to 30 percent of the time. For `Īao
30 Stream, the diverted amounts are in the range of the Q₇₀ flows and therefore divert all of
31 the stream waters about 30 percent of the time. Compare these percentages with the

1 percentage diversion of annual flows, as estimated by WWC. COL163, *supra*. These
2 comparisons confirm USGS's observations that the diversions are capable of diverting all
3 of the dry-weather flows available at the intakes. FOF 111, 116, 123, 131, 137.
4 Furthermore, because there has been a reduction in average flows up to about 14 percent
5 when the years 1984-2007 are compared to the years 2000-2007, the diverted amounts for
6 2005 and 2006 in Table 9 may result in higher percentages of the time when the
7 diversions take all of the stream flows.

8 9 **2. Expert Opinions on Amending the IIFS**

10 166. Habitat above the diversions is characterized by high flow, numerous riffles, and
11 cascades, while habitat below the diversions, where existing at all, is characterized by
12 low flow, infrequent riffles, and small shallow pools. FOF 560.

13 167. Opposing opinions can be summarized as follows:

14 1) Benbow, Hui/MTF's expert witness, concluded that "(p)ending firmer
15 scientific information from further studies, flow restoration should uphold two guiding
16 principles. First, the flow amounts must create enough quality habitat to support
17 sustainable, reproductive instream biological communities, taking into account public
18 uses such as Native Hawaiian gathering practices. Second, the flow amounts must
19 maintain enough continuous flow from mauka to makai to enable the streams to serve
20 their natural ecological functions, including sustaining the life cycles of the native
21 amphidromous species." FOF 556.

22 2) Ford, HC&S's expert witness, disagreed that continuous flow from mauka
23 to makai is necessary to enable the streams to serve their natural ecological functions and
24 distinguishes between physical connectivity versus ecological connectivity (stream flows
25 of sufficient volume and frequency to allow the normal distribution of native
26 amphidromous species within a given watershed). FOF 557.

27 3) Benbow's opinion is that no amount of mitigation of other factors can
28 compensate for a lack of streamflows; on the other hand, increased streamflows can go a
29 long way to mitigate the adverse effects of other factors. FOF 595.

30 4) Benbow's studies in `Iao Stream documented substantial amphidromous
31 migration when flow connected to the ocean for more than three or four days and thus

1 anticipated that with continuous flow, amphidromous species would reestablish into the
2 upper reaches of `Īao Stream. FOF 594. The Division of Aquatic Resources' ongoing
3 biological surveys and monitoring have also documented amphidromous recruitment in
4 the channelized section in `Īao Stream during intermittent flows. FOF 593.

5 5) HC&S's expert witnesses concluded that the contributions of one healthy
6 stream to the populations of amphidromous species in neighboring streams cannot be
7 overlooked. On a regional basis, this tends to compensate for the absence of significant
8 reproducing populations in the other streams. FOF 597.

9 6) Benbow was of the opinion that each stream is a natural system, and
10 differences in the characteristics of the streams and their watersheds should be taken into
11 account. FOF 598.

12 168. The approach to amending the IIFS of Benbow, Hui/MTF's expert witness, and
13 the response of HC&S's expert witnesses were as follows:

14 1) "Short of restoration of 100 percent of natural flows, the working
15 presumption should be that the streams of Nā Wai `Ehā need no less than 75 percent of
16 annual median flow to maintain their overall biological and ecological integrity over the
17 short and long term." FOF 577.

18 2) Benbow uses the median to measure total streamflow, which, in his
19 opinion, is the "preferred measure of typical flow conditions" instead of mean (or
20 "average") flow. The median is synonymous with Q_{50} , or the flow equaled or exceeded
21 50 percent of the time. FOF 578.

22 3) Benbow's recommendation of releases of 75 percent of the annual Q_{50} of
23 the Nā Wai `Ehā streams computes to flow values approximately between the Q_{65} and
24 Q_{85} of the streams. These duration values mean that 15 to 35 percent of the time,
25 streamflows will be naturally lower even without any diversions. FOF 579.

26 4) Benbow's recommendation nearly matches the Q_{70} level, or what USGS
27 theorizes is the mean base flow component of total flow; however, Benbow stated that he
28 did not rely on that fact for his recommendation. FOF 580.

29 5) Benbow stated that "(t)he 75 percent of median recommendation is less
30 than optimal, but incorporates a margin of safety to compensate for natural or other
31 variations in streamflow, which may include long-term drought if a moving median is

1 adopted. The margin of safety accounts also for the absence of more detailed scientific
2 information on the necessary flow amounts. Lesser amounts would foreclose benefits to
3 stream life and ecology and the opportunity for the necessary studies to determine
4 whether our best estimates of the minimum flows should be maintained or modified.”
5 FOF 581.

6 6) When asked to clarify how “annual median flow” would be calculated,
7 Benbow stated that a “starting place” would be the historical median flow for the period
8 between 1984 to 2005. However, he also proposed that the 75 percent figure be adjusted
9 periodically. For example, every six months, the median flow for the previous year would
10 be calculated, and 75 percent of that flow would be released. FOF 582.

11 7) Benbow’s 75 percent figure is supposed to represent a “null hypothesis.”
12 However, Payne, HC&S’s expert witness, stated that varying the 75 percent figure every
13 six months would defeat the purpose of testing if a control flow has any effect on the
14 stream. It would be impossible to isolate test variables if the control flow were adjusted
15 over the test period. FOF 583.

16 8) Benbow testified that the 75 percent figure is an “informed guess.” He
17 also conceded that the amount of flow needed could be less. FOF 585.

18 9) Benbow is unaware if any member of the working group at the USGS
19 stakeholder meeting has endorsed recommending to the Commission that the appropriate
20 instream flow standard should be 75 percent of the annual median flow. FOF 586.

21 10) Payne, one of HC&S’s expert witnesses, testified that the technique of
22 using flow duration curves to derive instream flow recommendations is well established
23 in the scientific literature. The Tennant Method has as a basis various percentages of the
24 mean annual flow. The New England Base Flow Method uses the median August flow to
25 set a minimum flow value. Many others select specific flow duration values by either
26 season or month. None of these methods, however, specify 75 percent of the Q_{50} .
27 Typically, when a hydrograph is used to set flow, the flow will be based on a specific
28 flow duration value rather than a variable percentage of a flow duration value. Payne is
29 unaware that Benbow’s approach has ever been applied or tested on Hawaiian or any
30 other streams. Therefore, Payne concluded that the argument that 75 percent of the Q_{50} is
31 required to accomplish his stated objectives appears to be based on Benbow’s personal

1 judgment and opinion, is unsupported by published literature, and is without
2 implementation history or precedent. FOF 584.

3 11) The flow rate recommended by Benbow cannot be sustained because it
4 could exceed the natural flow of the stream. For instance, the Q_{75} of Waihe'e Stream is
5 between 20 to 30 mgd (USGS historical data indicate that the Q_{70} flow of Waihe'e
6 Stream is 29 mgd). Yet, the flow of Waihe'e Stream is frequently less than 20-30 mgd
7 even under undiverted conditions. FOF 587.

8 12) The releases proposed by Benbow for a period of at least five years is his
9 personal opinion. FOF 588.

10 169. The approach to amending the IIFS by HC&S's expert witnesses and the response
11 of Benbow, Hui/MTF's expert witness, were as follows:

12 1) Contrary to Benbow's suggestion that a large volume of flow be restored
13 and sustained for a long period of time, Ford, HC&S's expert witness, recommended that
14 restoration of flows, if any, should begin at a low level and increased incrementally over
15 time. Starting with a low level of releases helps in determining the incremental
16 contributions of flow and their significance. Adequate time should be allowed to study
17 both changes in habitat and biological responses to the releases at each increment.
18 Starting with low increases in flows quickly results in a large benefit in terms of
19 increasing the wetted habitat area of a stream. At higher flows, the increase in wetted
20 habitat area from increasing flows becomes much less dramatic. FOF 589.

21 2) Benbow stated that his recommendation of much higher flows
22 incorporates a margin of safety to compensate for natural or other variations in
23 streamflow. The margin of safety accounts also for the absence of more detailed scientific
24 information on the necessary flow amounts. FOF 581.

25 3) HC&S's expert witnesses concluded that the contributions of one healthy
26 stream to the populations of amphidromous species in neighboring streams cannot be
27 overlooked. The larval drift sampling conducted by SWCA found large numbers of
28 'o'opu larvae in Waihe'e Stream and none in the three other streams. This suggests that
29 Waihe'e Stream contributes thousands of 'o'opu larvae to the oceanic pool. On a regional
30 basis, this tends to compensate for the absence of significant reproducing populations in
31 the other three Nā Wai 'Ehā Streams. FOF 596.

1 4) Benbow was of the opinion that each stream is a natural system, and
2 differences in the characteristics of the streams and their watersheds should be taken into
3 account. FOF 598.

4 5) HC&S's expert witnesses recommended that the addition of flow to
5 Waihe'e River and Waiehu Streams would yield the most benefit in terms of increasing
6 populations of native amphidromous species in the Nā Wai 'Ehā area. The key is to place
7 flow in streams in which existing alterations of habitat are minimal. Waihe'e River
8 provides significant habitat for all life stages of native amphidromous species. Waiehu
9 Stream, while not an ideal candidate for restoration due to its narrow channel and cultural
10 disturbances in the middle reaches, nevertheless showed signs of ecological connectivity.
11 By comparison, it is highly questionable whether increased flows in 'Īao Stream would
12 mitigate the impediment to recruitment posed by the channelization of the stream. There
13 is also no definitive evidence that Waikapū Stream ever carried uninterrupted surface
14 waters to the sea. FOF 590.

15 6) However, they admitted that the larval drift surveys they conducted did
16 not address the issue of the relative importance of channelization versus lack of flow and
17 that no data or study that they knew of demonstrated that channelization is more
18 important. FOF 592.

19 7) On the question of whether or not Waikapū Stream flowed continuously
20 to the ocean under uninterrupted conditions, they acknowledged that, ultimately,
21 restoration of flow would answer whether Waikapū Stream flows mauka to makai. FOF
22 595.

23
24 **3. The Parties' Proposed IIFS**

25 170. On the basis of their expert witness, Hui/MTF, joined by OHA, recommended the
26 following amended IIFS: 1) Waihe'e River: a) 25.5 mgd immediately downstream of the
27 Waihe'e Ditch Diversion; b) 27.5 mgd immediately downstream of the Spreckels Ditch
28 diversion; and c) at the mouth: the flow remaining in the stream after diversion of (1) up
29 to 2.0 mgd to satisfy kuleana and T&C users downstream of the Spreckels Ditch
30 diversion who take water directly from Waihe'e Stream and (2) up to 2.5 mgd for the
31 uses of Maui Coastal Land Trust; 2) North Waiehu Stream: 2.5 mgd immediately below

1 the North Waiehu diversion; 3) South Waiehu Stream: 2.5 mgd immediately below the
2 South Waiehu diversion; 4) at the mouth of Waiehu Stream: the flow remaining after
3 diversion of 0.07 mgd for the use of kuleana and T&C users; 5) `Īao Stream: a) 18.8 mgd
4 immediately downstream of the `Īao intake; and b) at the mouth: the flow remaining after
5 the diversion of up to 2.0 mgd to satisfy kuleana and T&C users who take water directly
6 from the stream; 6) Waikapū Stream: a) 4.1 mgd immediately below the Reservoir 6
7 intake; b) at the mouth: the flow remaining after the diversion of up to 0.35 mgd for the
8 uses of kuleana and T&C users who take water directly from the stream; and c) if
9 Waikapū Stream flow has not reached Kealia Pond within 120 days from the effective
10 date of the IIFS, then there shall be no IIFS at the mouth, and the IIFS immediately
11 upstream of the Reservoir 6 intake shall be the amount remaining after the diversion of
12 up to 0.35 mgd for the uses of kuleana and T&C users who take water directly from the
13 stream. Hui/MTF Proposed D&O, Section II.A-D.

14 171. On the basis of their expert witnesses, HC&S recommended the following
15 amended IIFS: 1) Waihe`e River: a minimum flow of 2 mgd to 3 mgd measured below
16 the Spreckels Ditch intake; 2) North Waiehu Stream: a minimum flow of 0.15 mgd to
17 0.25 mgd below WWC's diversion on North Waiehu Stream; 3) South Waiehu Stream: a
18 minimum flow of 0.15 mgd to 0.25 mgd below HC&S' diversion on South Waiehu
19 Stream; and 4) `Īao and Waikapū Streams: not viable candidates for restoration and
20 therefore deny the requests for amendment of their IIFS. HC&S Proposed D&O, Section
21 II.1.A-D.

22 172. WWC recommended the following amended IIFS: 1) Waihe`e River: 1.4 mgd
23 below the Spreckels Ditch; 2) North Waiehu Stream: 0.5 mgd below the North Waiehu
24 Ditch; 3) South Waiehu Stream: 0.5 mgd below the South Waiehu Ditch; 4) `Īao Stream:
25 4.2 mgd below WWC's `Īao Ditch and 1.4 mgd below HC&S's diversion into the
26 Spreckels Ditch; and 5) Waikapū Stream: 1.1 mgd below the inactive Everett Ditch and
27 0.4 mgd below the Reservoir 6 Ditch. WWC Proposed D&O, Section XV.1.

28 173. MDWS recommended the following amended IIFS: after allocating sufficient
29 water to meet existing kuleana needs; allocating up to 3.2 mgd to the County of Maui to
30 meet its current needs for the municipal water supply; reserving an allocation of 9.0 mgd
31 to meet the County of Maui's future needs for the municipal water supply; and allocating

1 6.1 mgd to HC&S to meet irrigation needs for HC&S's fields (other than Field 920) that
2 cannot be irrigated by water from HC&S's Well No. 7, all remaining stream water
3 currently diverted by Wailuku Water Company shall be returned to the streams. MDWS
4 Proposed D&O, Section III.B.

5
6 **4. The Commission's Analysis and Conclusions**

7
8 **a. MDWS's Proposed IIFS**

9 174. MDWS would return all remaining waters into the streams after allocating
10 sufficient water to meet the needs of what it had concluded were reasonable and
11 beneficial offstream uses. COL 173, *supra*.

12 175. This approach would be in direct conflict with the Supreme Court's ruling in
13 **Waiāhole I**: amending the IIFS comes first, and non-instream (offstream) uses are then
14 met with the remainder. **Waiāhole I**, 94 Haw. at 153, 9 P.3d at 465. MDWS's approach
15 would give absolute priority and a categorical imperative to any and all public and private
16 offstream diversions that can meet the reasonable/beneficial test, when even public trust
17 purposes (e.g., stream restoration) are denied that status. As such, MDWS's approach
18 turns the public trust doctrine on its head.

19
20 **b. WWC's Proposed IIFS**

21 176. WWC's proposed amendments would do the following: 1) Waihe'e River: the
22 proposed IIFS of 1.4 mgd would be less than even the lowest recorded flow (Q₁₀₀) of 14
23 mgd (Q₉₀ of 24 mgd) above all diversions; 2) Waiehu Stream: the proposed IIFS of 0.5
24 mgd each for the North and South branches would be less than the lowest recorded flow
25 (Q₁₀₀) for North Waiehu of 1.6 mgd (Q₉₀ of 1.4-2.7 mgd) and for South Waiehu of 1.5
26 mgd (Q₉₀ of 1.3 to 2.0 mgd) above all diversions; 3) `Īao Stream: the proposed IIFS of
27 4.2 mgd below WWC's `Īao Ditch and 1.4 mgd below HC&S's diversion into the
28 Spreckels Ditch would both be below the lowest recorded flow (Q₁₀₀) of 7.1 mgd (Q₉₀ of
29 13 mgd) above all diversions; and 4) Waikapū Stream: the proposed IIFS of 1.1 mgd
30 below the inactive Everett Ditch and 0.4 mgd below the Reservoir 6 Ditch would both be

1 below the lowest recorded flow (Q_{100}) of 3.3 mgd (Q_{90} of 3.3 to 4.6 mgd) above all
2 diversions. COL 157-160, 172, *supra*.

3 177. The reasoning behind WWC's proposed IIFS is as follows:

4 a) Base flow reflects the amount of water in the stream in extended dry
5 periods. WWC Proposed FOF 337.

6 b) If the amount of water necessary to satisfy instream and non-instream uses
7 exceeds the base flow, the competing uses must be balanced to both protect the resource
8 and provide for its beneficial use, citing HRS §174C-71(2)(D)). WWC Proposed FOF
9 338.

10 c) An IIFS that exceeds the base flow of a stream would not result in a
11 weighing of instream and non-instream uses. WWC Proposed FOF 342.

12 d) An IIFS that does not apportion some of the base flow would not result in
13 a balancing of the instream and non-instream uses. WWC Proposed FOF 343

14 e) Current non-instream use of each stream exceeds both the base flow and
15 the duration curve data amounts suggested for adoption as an IIFS. WWC Proposed FOF
16 346.

17 f) WWC concludes that the lowest recorded stream flow represents base
18 flow. WWC Proposed FOF 459, 592, 682, 702, 787.

19 178. WWC then determined what proportion of the lowest recorded flow, its definition
20 of "base flow," should be returned to the stream, because "current non-instream use of
21 each stream exceeds both the base flow and the duration curve data amounts suggested
22 for adoption as an IIFS." COL 176(e), *supra*. In other words, because WWC has
23 determined that current non-instream use is taking all of the base flow, some of it must be
24 returned to the stream. However, because WWC also concluded that "(a)n IIFS that does
25 not apportion some of the base flow would not result in a balancing of the instream and
26 non-instream uses, COL 176(d), *supra*, it reasoned that all of the base flow cannot be
27 returned to the stream.

28 179. WWC did not explain why it concluded that such a small proportion of the lowest
29 flows recorded should comprise the amended IIFS: 1) 1.4 of 14 mgd for Waihe'e River;
30 2) 0.5 of 1.6 mgd for North Waiehu Stream and 0.5 of 1.5 mgd for South Waiehu Stream;

1 3) 4.2 and, further downstream, 1.4 of 7.1 mgd for ʻĪao Stream; and 4) 1.1 and, further
2 downstream, 0.4 of 3.3 mgd for Waikapū Stream. COL 175, *supra*.

3 180. Furthermore, through its method, while only a portion and not the whole of the
4 lowest minimum flows are returned to the streams, noninstream uses have total access to
5 all flows over the minimally record ones. In other words, while WWC would “give back”
6 a minority portion of the minimally recorded flows that have been diverted, all other
7 flows would be available for diversion.

8 181. First, base flow does not only reflect the amount of water in the stream in
9 extended dry periods. While base and total flow are nearly the same in dry periods, base
10 flow varies with total stream flows. USGS’s model estimates the fraction of total flows
11 that represents the ground water contribution, and that model estimates that the ground
12 water contribution rises with rising stream flows. FOF 98-103.

13 182. Second, neither the definition of “instream flow standard” nor the weighing of
14 instream values with noninstream uses: 1) mentions base flow; 2) requires that the
15 weighing must apportion only some of the base flow to the amended IIFS; or 3) prohibits
16 establishing the IIFS above the base flow. HRS §§ 174C-3, 174C-71(2)(D).

17 183. Third, while the Supreme Court has concluded that “reason and necessity dictate
18 that the public trust may have to accommodate offstream diversions inconsistent with the
19 mandate of protection, to the unavoidable impairment of public instream uses and
20 values,” **Waiāhole I**, 94 Haw. At 141, 9 P.3d at 453, there is also a presumption in favor
21 of the streams, whose maintenance in their natural states is a public trust purpose, and
22 private commercial uses bear the burden of justifying their uses in light of the purposes
23 protected by the trust. COL 15, *supra*. WWC reverses this presumption and burden of
24 proof by allocating only a minor portion of the lowest recorded stream flows to make up
25 the entire amended IIFS, with the major portion and any flows above the lowest recorded
26 stream flows available for offstream uses. And WWC advocates this course of action
27 without explaining its “reason and necessity.”

28 184. Fourth, even if WWC’s reasoning were consistent with the law, none of WWC’s
29 proposed IIFS would result in continued mauka to makai flows. Waihe’e River loses 2.1
30 to 5.9 mgd (USGS assumes a constant loss of 4 mgd for planning purposes) downstream
31 of the Spreckels Ditch. North Waiehu Stream loses an estimated 1.3 mgd between the

1 North Waiehu Ditch and the confluence of North and South Waiehu Streams. Waiehu
2 Stream loses an estimated 0.6 mgd between the confluence and the mouth. `Īao Stream
3 loses an estimated 6.3 mgd from WWC's diversion to the mouth. Waikapū Stream has
4 major infiltration losses downstream of all diversions so that it is unclear if even the
5 entire natural flow would have reached the mouth. COL 157-160, FOF 109, 115, 121,
6 129, 137. All of WWC's proposed IIFS would infiltrate into the stream beds before they
7 reached the mouth of the streams.

8
9 **c. Hui/MTF's and OHA's Proposed IIFS**

10 185. Hui/MTF, joined by OHA, proposed the following amended IIFS: 1) Waihe`e
11 River: a) 25.5 mgd immediately downstream of the Waihe`e Ditch Diversion; b) 27.5
12 mgd immediately downstream of the Spreckels Ditch diversion; and c) at the mouth: the
13 flow remaining in the stream after diversion of (1) up to 2.0 mgd to satisfy kuleana and
14 T&C users downstream of the Spreckels Ditch diversion who take water directly from
15 Waihe`e Stream and (2) up to 2.5 mgd for the uses of Maui Coastal Land Trust; 2) North
16 Waiehu Stream: 2.5 mgd immediately below the North Waiehu diversion; 3) South
17 Waiehu Stream: 2.5 mgd immediately below the South Waiehu diversion; 4) at the mouth
18 of Waiehu Stream: the flow remaining after diversion of 0.07 mgd for the use of kuleana
19 and T&C users; 5) `Īao Stream: a) 18.8 mgd immediately downstream of the `Īao intake;
20 and b) at the mouth: the flow remaining after the diversion of up to 2.0 mgd to satisfy
21 kuleana and T&C users who take water directly from the stream; 6) Waikapū Stream: a)
22 4.1 mgd immediately below the Reservoir 1 intake; b) at the mouth: the flow remaining
23 after the diversion of up to 0.35 mgd for the uses of kuleana and T&C users who take
24 water directly from the stream; and c) if Waikapū Stream flow has not reached Kealia
25 Pond within 120 days from the effective date of the IIFS, then there shall be no IIFS at
26 the mouth, and the IIFS immediately upstream of the Reservoir 1 intake shall be the
27 amount remaining after the diversion of up to 0.35 mgd for the uses of kuleana and T&C
28 users who take water directly from the stream. COL 170, *supra*. (**Note:** Reservoir 1
29 receives water from the Waikapū Ditch, and Hui/MTF and OHA may be referring to
30 Reservoir 6, which is further downstream, see Figure 4.)

1 186. These proposed IIFS are based on their expert witness's recommendation that the
2 IIFS be established at 75 percent of "annual median flow." A "starting place" would be
3 the historical median flow for the period between 1984 to 2005, and then adjusted
4 periodically. For example, every six months, the median flow for the previous year would
5 be calculated, and 75 percent of that flow would be released. COL 168(6), *supra*. FOF
6 582. However, their proposed IIFS are not adjusted yearly, as was recommended by their
7 expert witness.

8 187. Their expert witness recommended 75 percent of the median (Q_{50}) flows to
9 maintain overall biological and ecological integrity over the short- and long-term, COL
10 168(1), *supra*, FOF 577, but he did not explain further how this specific level for the IIFS,
11 to be adopted for all four streams, would accomplish those purposes. For example, what
12 does he mean by "short-term" biological and ecological integrity? Short-term effects
13 could include indications of the "quality habitat," but whether these changes are able "to
14 support sustainable, reproductive instream biological communities," COL 167(1), *supra*,
15 FOF 556, can only be answered over the long-term.

16 188. Instead, their expert witness stated that the 75 percent of the median flow was "an
17 informed guess" and that it could be less. COL 168(8), *supra*. FOF 585.

18 189. When queried whether his recommendation nearly matches the Q_{70} level, or what
19 USGS theorizes is the mean base flow component of total flow, their expert witness
20 stated that he did not rely on that fact for his recommendation. COL 168(4), *supra*. FOF
21 580. However, given that his reason was "an informed guess" without the reasons for
22 why he chose that specific level and that he conceded that it could be less, the
23 Commission concludes that it is more than coincidence that the 75 percent of mean (Q_{50})
24 flow, or Q_{65} to Q_{85} , closely coincides with the mean base flow component of total flow,
25 or Q_{70} . Without any explanation beyond an informed guess, the Commission interprets
26 the expert witness's recommendation for the IIFS for all four streams as their mean base
27 flows, a theoretical calculation that can never be empirically reproduced and which was
28 not conceptualized as a means for establishing IIFS. FOF 101-103, 105.

29 190. The Commission is not categorically against using mean base flow or closely
30 related flows to establish the IIFS, only that, in this case, there is insufficient support for

1 the expert witness to choose that flow other than it is his “informed guess” without any
2 more information of what he meant by “informed.”

3 191. Even if the expert witness could have provided an adequate basis for choosing 75
4 percent of median flow, he would have had to provide sufficient reasons for each stream
5 and not categorically apply it to all four. The expert witness himself was of the opinion
6 that each stream is a natural system, and differences in the characteristics of the streams
7 and their watersheds should be taken into account. COL 167(6) *supra*. FOF 598.

8 192. The proposed IIFS at the mouth of the four streams are also contrary to the law in
9 the same manner as MDWS’s proposed IIFS; i.e., amending the IIFS comes first, and
10 non-instream (offstream) uses are then met with the remainder. **Waiāhole I**, 94 Haw. at
11 153, 9 P.3d at 465. COL 175, *supra*. In each of the four streams, the proposed IIFS at the
12 stream mouth would be the flow remaining after diverting water for kuleana and
13 traditional and customary users. COL 170, *supra*.

14 193. The proposed IIFS also do not strike a balance between instream values and
15 offstream users. The proposed IIFS for `Īao and Waikapū Streams are arbitrary by
16 denying, without explanation, the diversions by HC&S of `Īao Stream at the Spreckels
17 Ditch and by WWC of Waikapū Stream at the Waihe`e Ditch, while allowing for all other
18 of WWC’s and HC&S’s diversions. **Compare** FOF 181 and 186 with COL 170, *supra*.

19 194. The proposed IIFS, set between 65 and 85 percent of Q₅₀, **compare** COL 170,
20 *supra*, and Table 9, would mean that all offstream uses, including kuleana and traditional
21 and customary uses, would have no access to water 15 to 35 percent of the time. In
22 addition, for those periods of time in which flows above the IIFS are less than the amount
23 of offstream uses (to be determined in the water use permit application process under the
24 designation of the four streams as a surface water management area) there will be
25 insufficient water for those offstream users.

26 195. The Commission is not concluding that it must establish the IIFS so that offstream
27 uses are fully accommodated; only that there must be a **balancing** of instream values with
28 non-instream uses when both needs cannot be met.

29
30
31

1 **d. HC&S's Proposed IIFS**

2 196. HC&S proposed the following amended IIFS: 1) Waihe`e River: a minimum flow
3 of 2 mgd to 3 mgd measured below the Spreckels Ditch intake; 2) North Waiehu Stream:
4 a minimum flow of 0.15 mgd to 0.25 mgd below WWC's diversion on North Waiehu
5 Stream; 3) South Waiehu Stream: a minimum flow of 0.15 mgd to 0.25 mgd below
6 HC&S' diversion on South Waiehu Stream; and 4) `Iao and Waikapū Streams: not viable
7 candidates for restoration and therefore deny the requests for amendment of their IIFS.
8 COL 171, *supra*. In its May 11, 2009, written exceptions to the Proposed FOF, COL, and
9 D&O, HC&S amended its proposed IIFS for Waihe`e River and `Iao Stream from 2-3
10 mgd to 5 mgd for Waihe`e River and from no IIFS to 4 mgd for `Iao Stream (pp. 37-38).

11 197. The proposed IIFS were based on the following proposed Conclusion of Law: The
12 currently available scientific evidence indicates that Waihe`e Stream has significant
13 reproducing populations of native Hawaiian amphidromous species and that ecological
14 connectivity was also found in Waiehu Stream, although it is a less promising candidate
15 for restoration than Waihe`e Stream given its narrow stream channel and low flow
16 volume under undiverted conditions, alterations to the stream caused by cultural
17 disturbances, and the concrete apron below the culverts under Kahekili Highway. No
18 ecological connectivity was found in `Iao and Waikapū Streams, and each of those
19 streams present inherent challenges to the propagation of amphidromous species at
20 various stages of their life cycle. In the case of `Iao Stream, channelization of the stream
21 bed in the lower reaches impedes post-larval recruitment. The apparent lack of a direct
22 connection between Waikapū Stream and the ocean interferes with migration and
23 recruitment. Thus, it is unlikely that the addition of stream flow to `Iao and Waikapū
24 Streams would result in the presence of reproductive populations of amphidromous
25 organisms in those streams. HC&S's Proposed COL 6. As with WWC's proposed IIFS,
26 the proposed IIFS for Waihe`e River and North and South Waiehu Streams are minority
27 fractions of the lowest recorded flows. **See** FOF 107, 113 and 119 for the minimum flows,
28 and COL 179, *supra*.

29 198. In its Proposed Decision and Order, HC&S refers to restoring "a portion of the
30 natural stream flow," HC&S's Proposed Decision and Order, II.1, and its proposed IIFS

1 make it apparent that “natural stream flow” is equivalent to WWC’s “base flow” and that
2 both are equated to the lowest recorded flows.

3 199. Conclusions of Law 181-184 for WWC, *supra*, apply equally to HC&S’s
4 proposed IIFS for Waihe`e River and North and South Waiehu Streams. HC&S’s
5 proposed amended IIFS from 2-3 mgd to 5 mgd for Waihe`e River and from no IIFS to 4
6 mgd for `Iao Stream, COL 196, *supra*, would still not result in continuous flow to the
7 mouth, COL 184, *supra*, despite HC&S’s belief that flows would result, contrary to
8 expert testimony by USGS. FOF 109, 129. COL 157, 159, *supra*.

9 200. As for `Iao Stream, experts differed on the significance of channelization on post-
10 larval recruitment, and there have been observations of amphidromous recruitment in the
11 channelized section when flow connected to the ocean. COL 167(4), *supra*, FOF 593.
12 The larval drift surveys did not address the issue of the relative importance of
13 channelization versus lack of flow and there are no data or study demonstrating that
14 channelization is more important. COL 169(6), *supra*. FOF 592.

15 201. As for Waikapū Stream, ultimately, restoration of flow would answer whether it
16 flows mauka to makai. COL 169(7), *supra*. FOF 595.

17
18 **5. The Commission’s Analysis and Amendments to the IIFS**

19
20 **a. Analysis**

21
22 **1. Overview**

23 202. Construction of the Spreckels Ditch began in 1882, the `Iao and Waiehu ditch
24 systems began around 1900, and the Waihe`e Ditch began in 1905. FOF 167-169.
25 Starting with the very first water case addressed by the Hawaii Supreme Court and
26 continuing until 1973, surface waters in Hawai`i could be treated as private property, and
27 those with such “prescriptive” rights had superior rights to the common law “riparian”
28 rights (for example, rights to stream waters by owners of land adjacent to the stream, in
29 amounts that were not injurious to the rights of other owners of land adjacent to that
30 stream). The Court used the Hawaiian ahupua`a system as its rationale for ruling that the
31 taking of water for other than use on riparian lands was the superior right:

1 So if a riparian proprietor should interfere with an ancient auwai, by which other
2 lands had been watered from time immemorial, he would be liable in damages,
3 because this was clearly an easement for the benefit of those lands through which
4 the ancient water course extended...(A) right to interfere with the natural right to
5 make use of water belonging to another, when it is connected with the occupation
6 of lands, constitutes an easement in favor of the latter, as the dominant estate.
7 Peck v Bailey, 8 Haw. 658, at 661-662 (1867).

8
9 The Court continued to expand on the rights to own surface waters, ruling that it was not
10 necessary for the water to be used on the land which had the prescriptive rights, Lonoaea
11 v Wailuku Sugar Co., 9 Haw. 651 (1893), Horner v Kumuliilii, 10 Haw. 174 (1895),
12 Wong Leong v Irwin, 10 Haw 265 (1896), thereby straying far away from its initial
13 justification of ownership based on the ahupua`a system, and finally ruling in 1930 that:

14 Riparian rights is not and ever has been the law in Hawaii. It is utterly
15 inconsistent with the system which from time immemorial has been recognized
16 and enforced in these Islands...Even the *kuleanas* awarded in 1845 or thereabouts
17 to the common people, the poorer people, a great many, and perhaps most of them,
18 were nonriparian and would never have been entitled and would not now be
19 entitled under that system to any water from the streams. The system devised and
20 wisely provided by the ancient kings and chiefs permitted of the construction and
21 maintenance of a large network of artificial ditches...That system provided for
22 every kuleana, ili and ahupuaa fed by those ditches more water and greater rights
23 than those which would have been available under the riparian system, even as to
24 those lands which were themselves riparian...There was no limitation to a
25 “reasonable use” for the lands entitled to take from any of the ditches...There was
26 no limitation in favor of lands within the same watershed or valley. Territory v
27 Gay, 31 Haw. at 396-400.

28
29 203. Forty-three years after Territory v Gay completed the privatization of surface
30 waters in Hawaii, the Court reversed course, ruling that: 1) title to water was not intended
31 to be, could not be, and was not transferred to an awardee by the Great Mahele and
32 subsequent Land Commission Award and issuance of Royal Patent; 2) the ownership in
33 natural watercourses, streams, and rivers remained in the people of Hawai`i for their
34 common good; 3) riparian rights exist and belong only to land adjoining a natural
35 watercourse for its own use; and 4) appurtenant rights apply only in connection with the
36 particular parcel of land to which the right is appurtenant. McBryde, 54 Haw. 174; 504
37 P.2d 1330 (1973). The intensity of the controversy surrounding this decision is reflected
38 in the comments by Chief Justice Richardson: “In 1897, Hawaii was annexed by the

1 United States and until 1959 was a territory with our judges and justices appointed by the
2 President of the United States with the advice and consent of the United States Senate. In
3 1959, Hawaii became a state... While the decisions of the territorial courts were
4 unquestionably binding upon the parties before it, we doubt whether those essentially
5 federal courts could be said to have definitely established the common law of what is
6 now a state. So long as the federal government was sovereign its authority to frame the
7 law was unquestionable, but upon our assumption of statehood our own government
8 assumed the whole of that responsibility, absent any explicit federal interest. And it is
9 from our authority as a state that our present common law springs (emphasis in
10 original).” **Robinson v Ariyoshi**, 65 Haw. 641, at 667, n. 25; 658 P.2d 287, at 306, n. 5
11 (1982).

12 204. In this CCH, the Commission must address the diversions that were constructed
13 under the laws prevailing under COL 202, *supra*, and amend the IIFS under the present
14 case laws, statutory laws, and the state Constitution under which water is a public trust
15 resource, as initiated by **McBryde** in 1973. This duty fundamentally turns on its head the
16 laws that were prevailing when the ditches were constructed and whose diversion
17 practices continue to this day. Current practices serve offstream uses first, with the
18 streams left with whatever flows that are not diverted on a day-to-day basis. But the
19 flashy nature of Hawai`i’s streams, with flows highly dependent on rainfall on even a
20 day-to-day basis, makes management of offstream uses difficult even when such uses
21 have first call on stream flows. Under current laws, the IIFS has to be determined first,
22 and what water remains would be available for offstream uses, COL 18, *supra*, subject to
23 the water-use permits requirements. This means that management of offstream uses will
24 still have to contend with the daily variations in stream flows but will also have to work
25 with a quantity of water that will have been reduced by the amounts that must remain in
26 the streams under the amended IIFS. Under WWC’s or HC&S’s proposed IIFS, only a
27 portion of the lowest flows recorded will constitute the amended IIFS. But the
28 Commission rejects this approach, based on its analysis. COL 176-184, 196-201. The
29 Commission also rejects the proposal of Hui/MTF, joined by OHA, for a number of
30 reasons, one of which is that setting the IIFS at Q₆₅₋₈₅ would mean that no water would be
31 available for offstream use 15 to 35 percent of the time and insufficient water for a

1 significant percentage more. COL 194, *supra*. In both cases—WWC and HC&S versus
2 Hui/MTF joined by OHA—accepting those proposals would be tantamount to a
3 “categorical imperative,” COL 14, *supra*, for the offstream uses on one hand, and stream
4 restoration on the other. Instead, the Commission “must weigh competing public and
5 private uses on a case-by-case basis...accommodating both instream and offstream uses
6 where feasible...consider(ing) the cumulative impact of existing and proposed diversions
7 on trust purposes and to implement reasonable measures to mitigate this impact,
8 including using alternative resources.” COL 16-17, *supra*.

9
10 **2. The Restorative Potential of the Nā Wai `Ehā Streams**

11 205. Because of the amphidromous life cycle of Hawaiian streams’ fish, mollusks, and
12 crustaceans, FOF 65-67, if the currently degraded habitat of Nā Wai `Ehā streams are
13 restored, recruitment and re-population are expected to occur. From the many expert
14 opinions presented at the CCH, including often diametrically opposed opinions in part
15 because of the adversial nature of the CCH process, the Commission reaches the
16 following conclusions:

17 206. While continuous stream flow from the source in the mountains to the mouth at
18 the ocean (“connectivity from mauka to makai”) is perhaps a necessary condition for
19 most of Hawai`i’s perennial streams to maximize and sustain and reproducing
20 amphidromous populations at pre-diversion levels, FOF 556, there are streams that are
21 naturally interrupted with healthy populations; i.e., with ecological instead of physical
22 connectivity, or stream flows of sufficient volume and frequency to allow the normal
23 distribution of native amphidromous species within a given watershed., FOF 557. These
24 competing perspectives clashed on the viewpoint of the restorative potential of `Īao
25 Stream in particular, where there has been extensive channelization with concrete in the
26 lower reaches and plans to complete that channelization down to the mouth of the stream.
27 FOF 128. One viewpoint is that it is the channelization, not the interrupted flow, that
28 prevents ecological connectivity; while the other viewpoint is that no amount of
29 mitigation of factors such as channelization can compensate for a lack of streamflow and
30 that increased streamflow can go a long way to mitigate the adverse effects of other
31 factors. FOF 590, 595.

1 207. The current balance between instream values and offstream uses, as represented
2 by the status quo IIFS established on December 10, 1988, COL 155, *supra*, reflects the
3 historical period when stream waters were considered private property. The Commission
4 concludes that restoring some flows is the best available tool at its disposal for restoring
5 streams' amphidromous species.

6 208. For `Iao Stream, a large obstacle is the channelization of the Stream that starts
7 about 2.5 miles above its mouth. Sufficient flow may allow recruitment through this area,
8 but the channelization will inhibit spawning or may prevent it altogether in the lower
9 reaches of `Iao Stream. The 20-foot vertical drop in the channelized area, below the
10 concrete channel above and the unlined channel below, is another obstacle, but fish
11 ladders can be constructed to bypass the vertical drop and allow recruitment of the stream
12 life that have climbing abilities. FOF 65, 128. The channelized lower portion, however,
13 may not support spawning in that area.

14 209. For Waikapū Stream, the principal issue is whether or not in dry weather, where
15 actual flow is approximately equal to base flow, the non-diverted stream flowed
16 continuously from mauka to makai or whether its natural flows infiltrated into the
17 streambed before reaching the mouth. FOF 137.

18 210. An additional impediment for recruitment of amphidromous species into Waikapū
19 Stream is that, when there is flow from Waikapū Stream to Kealia Pond during extensive
20 periods of flooding, the water does not travel via a continuous channel through the pond
21 and into the ocean, but instead, fans out into a big delta. FOF 567. Therefore, Waikapū
22 Stream may not have sustained amphidromous species even under pre-diversion
23 conditions.

24 211. There is evidence of some ecological activity in Waiehu Stream, with low
25 numbers of adult amphidromous species but no larvae in downstream drift samples
26 collected from the stream. At least two species of 'o'opu and amphidromous prawns were
27 found in the upper reaches of that stream, and recruits were found on the mauka side of
28 the culverts. FOF 564. However, there is extensive channel erosion below the Spreckels
29 Ditch on South Waiehu Stream, with a 12-foot drop in the elevation of the stream just
30 below the diversion, and there is a vertical concrete apron located just below the highway
31 culverts in lower Waiehu Stream. FOF 124. Fish ladders could be constructed, as

1 suggested for the much higher vertical drop in `Iao Stream. COL 208, *supra*. The 12-foot
2 drop, created by erosion, may not be an impediment to recruitment because of the
3 climbing activity of most amphidromous species, and a bypass may not be necessary
4 there.

5 212. In their present diverted states, Waihe`e River showed the most ecological activity.
6 The study conducted by HC&S's expert witnesses described Waihe`e River as having
7 normal patterns of migration, species and size distribution, and reproduction throughout
8 the stream under diverted conditions, with its larval drift sampling indicating that
9 Waihe`e River is the only stream that appears to have significant reproductive
10 populations of native amphidromous species. FOF 563. However, the study's many
11 limitations included it being "just a snapshot" and no larval drift studies having been
12 correlated with upstream abundance of the adults contributing the larvae, thereby limiting
13 conclusions on the quality or normality of Waihe`e River's reproductive output. FOF
14 573-576.

15 213. All four streams are dry downstream of all diversions during dry-weather
16 conditions. Minor flows are observed in the streams downstream of the diversions due to
17 return flows and leakage from the ditches. Waihe`e River has a measurable flow of about
18 0.1 mgd immediately downstream of the Spreckels Ditch, but the River is estimated to
19 lose from 2.1 to 5.9 mgd downstream of the Spreckels Ditch, so it also may not have
20 continuous surface flow from mauka to makai. FOF 109-111, 116, 122-123, 130-131,
21 136-137.

22 214. Thus, the restorative potential is highest for Waihe`e River, which already
23 exhibits reproductive activity, though the quality or normality of current reproductive
24 output is not known. Higher flows in periods of rainfall, when streamflows are not fully
25 diverted and/or rainfall and runoff downstream of the diversions result in flows that reach
26 from mauka to makai, must result in recruitment, which in turn leads to some reproducing
27 adults in the upper reaches of the River.

28 215. For Waiehu Stream, there is evidence that some recruitment has resulted in scarce
29 populations of adult amphidromous species in the upper reaches of the stream.
30 Improvements in traversing the 12-foot drop in the elevation of the stream just below the

1 diversion, if necessary, and the vertical concrete apron located just below the highway
2 culverts in lower Waiehu Stream should lead to further recruitment.

3 216. For `Īao Stream, recruitment can occur through the channelized portion of the
4 stream and the 20-foot vertical drop in the channelized area can be bypassed, but the
5 reproductive (spawning) potential of the channelized, lower stretches is minimal.

6 217. Waikapū Stream may not have flowed continuously mauka to makai prior to the
7 diversions, because of extensive infiltration of streamflow into the streambed in its lower
8 reaches. Even if it did flow continuously mauka to makai, recruitment might not have
9 occurred. When there is streamflow during extensive periods of flooding, it does not
10 travel via a continuous channel through Kealia pond and into the ocean, but fans out into
11 a big delta, further preventing recruitment.

12 13 **3. Reasonable Offstream Uses**

14 218. In balancing instream values with offstream uses, the Commission will not
15 recognize the economic impact on diverted water that is being used inefficiently, losses
16 that could be prevented through practical actions, or waters that have practical
17 alternatives. In this CCH, the purpose of estimating what are reasonable amounts of
18 current offstream uses is to determine what might be the economic impact of restricting
19 such uses, and is not determinative of the “reasonable-beneficial” requirement for
20 WUPAs under the surface water management area designation of Nā Wai `Ehā. COL 37-
21 43, *supra*. Thus, here, the Commission makes a general, collective assessment of the
22 reasonableness of offstream uses and not the WUPA-specific assessment with the burden
23 of providing information on the parties seeking water use permits.

24 219. For kalo lo`i on kuleana lands, 130,000 to 150,000 gad, or about 260,000 to
25 300,000 gad when adjusted for the 50 percent of the time that no water is needed to flow
26 into the lo`i, is sufficient for proper kalo cultivation. COL 56, *supra*. Consumption by the
27 lo`i themselves comprises 15,000 to 40,000 gad, COL 54, *supra*, so the large amounts of
28 inflow and outflow would result in substantial losses, which can be reduced if as much of
29 the outflow as practical is channeled back into the streams. Leakage from the inflow and
30 outflow ditches must also be reduced as much as practically possible. COL 57-58, *supra*.

1 220. The estimated 6.84 mgd delivered to kuleana lands, FOF 332, Table 7, is a
2 reasonable amount to meet both the flow-through and consumptive requirements of their
3 current and projected acreage in kalo lo`i. Only about 10 to 25 percent of this amount,
4 however, would be consumed by the kalo lo`i and most of the rest available downstream
5 if as much as practical of the outflows are diverted back into the streams. Therefore, the
6 net consumptive use by the kalo lo`i would be on the order of 0.68 mgd to 1.71 mgd.

7 221. Some kuleana landowners also use stream waters for domestic and other uses
8 (vegetables, trees, and plants). MDWS allocates up to 540 gpd for households and 600 to
9 1,200 gad for agricultural development lots, FOF 401-402, which are reasonable amounts
10 for kuleana lands for these purposes, but the kalo lo`i use is by far the dominant use. If
11 the upper estimate of kalo lo`i water consumptive use, 1.71 mgd, is applied, this amount
12 should be more than sufficient for kuleana landowners' domestic and other agricultural
13 uses.

14 222. While none of the kuleana lands have yet to be confirmed as having appurtenant
15 rights, if such rights are found to exist, there is no duty to meet the practical alternatives
16 test. COL 94, *supra*.

17 223. Maui Coastal Land Trust is seeking 1.5-2.5 mgd for wetlands restoration and
18 other related activities, which are reasonable amounts, COL 61, *supra*, but there is also a
19 practical alternative available from ground water underlying the wetlands. FOF 353.

20 224. MDWS receives up to 3.2 mgd of surface water from the `Īao-Waikapū Ditch and
21 has had informal discussions to increase the treatment facility's capacity from 3.2 mgd to
22 4.0 mgd and to build a new, up to 9 mgd surface water treatment facility. However, of the
23 current 3.2 mgd treatment facility capacity, MDWS has used only about 1 mgd (0.71 mgd
24 in 2005 and 1.08 mgd in 2006—see Table 7). Thus, MDWS's current and future use
25 should not take into account the informal discussions to raise the 3.2 mgd capacity to 4.0
26 or to build a new treatment facility. MDWS has no practical alternatives. COL 99.
27 Therefore, MDWS's reasonable use, COL 62, *supra*, of surface water is 3.2 mgd.

28 225. WWC estimates its system losses at 7.34 percent, or 4.31 mgd in 2005 and 3.80
29 mgd in 2006, averaging about 4.06 mgd over those two years. Table 7. Most of WWC's
30 ditches are unlined, and all of its many small reservoirs (See Figure 5) are unlined. FOF

1 375. Assuming that losses could be halved by lining most of its reservoirs, reasonable
2 losses would be about 2.0 mgd.

3 226. WWC's deliveries under its Water Delivery Agreements were 2.37 mgd in 2006,
4 up from 1.42 mgd in 2005, out of a total of 8.288 mgd in agreements with 34 entities.
5 FOF 307. Table 7. For two of the larger current or future users, reasonable amounts were
6 1.2 mgd or less for two currently operating golf courses. FOF 389, 395. COL 65.

7 Although only some of the parties currently receiving water testified, most had
8 alternative sources such as MDWS, or had no assurance of long-term leases on their
9 properties. Other projects were only in the conceptual or "tossing ideas around" stages.
10 FOF 388-389, 396-416. Thus, of the 2.37 mgd used in 2006, 1.17 mgd, or 2.37 mgd
11 minus the 1.2 mgd for the two golf courses, were found to have practical alternatives, and
12 total current and future reasonable uses without practical alternatives was 1.2 mgd.

13 227. The reasonable uses for HC&S is estimated at 5958 gad for the Waihe'e-Hopoi
14 Fields, or 21.75 mgd for 3650 acres and 5408 gad for the 'Iao-Waikapū Fields, or 6.06
15 mgd for 1120 acres, for a total of 27.81 mgd. COL 92-93, *supra*.

16 228. However, the daily requirements are estimated to range from: 1) a minimum of
17 4422 gad to a maximum of 6305 gad for the Waihe'e-Hopoi Fields, or from 16.14 mgd to
18 23.01 mgd; and a minimum of 3830 mgd to a maximum of 5836 mgd for the 'Iao-
19 Waikapū Fields, or from 4.29 mgd to 6.54 mgd. Together, total requirements range from
20 20.43 mgd to 29.55 mgd per day, compared to the average requirement of 27.81 mgd.

21 COL 227, *supra*. The median daily requirements are: 1) Waihe'e-Hopoi Fields: 5589 gad
22 or 20.40 mgd; 2) 'Iao-Waikapū Fields: 4993 gad or 5.59 mgd; and 3) for both fields
23 combined: 25.99 mgd. Table 11; COL 92-93, *supra*. This means that half of the time,
24 daily requirements would be less than 25.99 mgd, and conversely, half of the time, daily
25 requirements would be more than 25.99 mgd.

26 229. HC&S estimates that it loses 6 mgd to 8 mgd through seepage from the Waiale
27 Reservoir, depending on the level of the reservoir, and estimates seepage throughout its
28 ditch and reservoir system at 3 mgd to 4 mgd. It has not undertaken studies nor estimated
29 the costs to line Waiale Reservoir or the other reservoirs and ditches. COL 122-123,
30 *supra*. Given that HC&S has stated that "high density polyethylene lining could negate
31 much of the seepage, not all of it" for Waiale Reservoir, FOF 425, the Commission

1 estimates that it is practical to prevent 6-8 mgd of losses, or the seepage of the Waiale
2 Reservoir, and to halve the other 3-4 mgd in losses, as it has assumed for WWC, COL
3 225, *supra*, for a total reasonable loss of 2 mgd.

4 230. Alternative sources for HC&S include Well No. 7 and recycled wastewater. COL
5 103-107, *supra*. Wastewater from MLP will no longer be available, FOF 261, and the
6 county has no existing infrastructure to deliver recycled wastewater from its
7 Wailuku/Kahului treatment plant to HC&S's fields. FOF 107-108. Well No. 7, which can
8 irrigate the Waihe'e-Hopoi Fields, has two pumps at water level that historically can each
9 pump 17.5 mgd to ground level and also to reach 800 acres of the Waihe'e-Hopoi Fields'
10 3650 acres (at 5958 gad, this would equal 4.77 mgd), and one booster pump at ground
11 level that can pump 14 mgd into the Waihe'e Ditch to reach all fields except the 175-acre
12 Field 715. An additional 14 mgd booster pump would incur costs of \$1 million, and
13 \$475,000 in infrastructure costs would be incurred to reach Field 715. HC&S also claims
14 that there would be constraints on the power to run the pumps on a consistent and
15 sustained basis because of its power contract with MECO. COL 103-106, *supra*.
16 Although Well No. 7 historically had pumped approximately 19 mgd (14 mgd plus 4.77
17 mgd), it has been used only for two six month periods since the 1980s – in 1996 and in
18 2000, FOF 494-495. In the 1980s HC&S installed drip irrigation systems to reduce water
19 loss & increase efficiency of water delivery to the plants. FOF 445. Similarly in the
20 1980s WWC shifted from furrow irrigation to drip irrigation to increase reliability of
21 water delivery. FOF 215. The combined facts that the current sustainable yield of the
22 aquifer is already being exceeded; that increased pumping from Well No. 7 may
23 exacerbate that strain; and that the historically higher levels of pumping occurred during
24 a period where furrow irrigation methods were affecting recharge rates for the aquifer,
25 the practical alternative from Well No. 7 is lower than historic rates. Considering these
26 uncertainties in combination with the Commission's decision to place the full burden of
27 remedying losses immediately upon HC&S, discussed *intra*, the practical alternative from
28 Well No. 7 is deemed 9.5 mgd. This alternative will not require capital costs, only the
29 costs of pumping.

30 231. For HC&S, total reasonable uses are estimated at 29.81 mgd: 1) 6.06 mgd for the
31 'Īao-Waikapū Fields; 2) 21.75 mgd for the Waihe'e-Hopoi Fields; and 3) 2 mgd of

1 system losses remaining after subtracting the 6 mgd to 8 mgd of losses from Waiale
2 Reservoir and halving the estimated 3-4 mgd of losses in the ditch system. Practical
3 alternatives are 9.5 mgd from Well No. 7, for a net reasonable use of 20.31 mgd (but see
4 the variable nature of this alternative, explained below).

5 232. Therefore, total reasonable current and future uses, minus practical alternative
6 water sources, for all diverted stream waters are 28.42 mgd: 1) 1.71 mgd for the kuleana
7 lands; 2) 3.2 mgd for MDWS; 3) 3.20 mgd for WWC, consisting of 1.20 mgd for its
8 Water Delivery Agreements and 2 mgd for system losses; and 4) 20.31 mgd for HC&S,
9 consisting of 18.31 mgd for irrigation requirements and 2 mgd for system losses. The
10 Commission is also cognizant of the large variations in day-to-day requirements for
11 HC&S's fields described in COL 228, *supra*, and the reliability of Well No. 7 as a
12 permanent, day-to-day source of 9.5 mgd, COL 230, *supra*, and will address these issues
13 later in this Decision and Order.

14 233. If the total flow-through requirements for kalo lo'i are substituted for the
15 consumptive use (6.84 mgd in place 1.71 mgd), the total reasonable uses would be 26.18
16 mgd after subtracting for practical alternatives. As much as practical of these additional
17 amounts, however, would have to be returned into the streams downstream of the
18 diversions to the lo'i.

19 234. From Table 7, MDWS's 2005-2006 actual use averaged 0.90 mgd, and its current
20 and future reasonable use would be 3.2 mgd, based on the capacity of its water treatment
21 facility. Kuleana system users' flow-through requirements would remain at the 2005-
22 2006 level of 6.84 mgd, of which 1.71 mgd would be consumed by the taro lo'i. For
23 WWC's Water Delivery Agreements, average use in 2005-2006 was 1.90 mgd, and
24 reasonable current and future uses would be about 2.02 mgd. WWC's estimated system
25 losses averaged 4.06 mgd in 2005-2006, to be reduced to a reasonable loss of 2.0 mgd.

26 235. For HC&S's Waihe'e-Hopoi Fields, an average of 35.58 mgd was delivered to the
27 Waiale Reservoir. Actual use in 2004-2006 was 6828 gad on 3350 acres, or 22.87 mgd.
28 FOF 436. Therefore, 12.71 mgd, or 36%, was lost. Compared to actual use of 6828 gad,
29 or 22.87 mgd, estimated requirements were 5958 gad, or 19.96 mgd. Thus, actual use was
30 2.91 mgd, or 14.6%, over what was required. For the 'Iao-Waikapū Fields, an average of
31 10.43 mgd was delivered. Actual use in 2004-2006 was 7716 gad on 1330 acres

1 (including the 250 acres of Field 920), or 10.26 mgd. FOF 441. Thus, only 0.17 mgd was
2 lost. Excluding Field 920, actual use was 7098 gad on 1080 acres, or 7.67 mgd. Estimated
3 requirements for these 1080 acres were 5408 gad, or a total of 5.84 mgd. Thus, actual use
4 was 1.83 mgd, or 31%, over what was required.

5 236. In total, for both the Waihe`e-Hopoi and `Iao-Waikapū Fields, not counting the
6 higher use per acre on Field 920's 250 acres, irrigation overuse in 2005-2006 was 4.74
7 mgd over requirements of 25.80 mgd, or 18%. Losses, on the other hand, totaled 12.88
8 mgd, or 36% of the average total delivery of 46.01 mgd. Ninety-nine percent of losses
9 were attributable to the Waihe`e-Hopoi Fields/Waiale Reservoir (12.71 mgd of 12.88
10 mgd). Table 12 summarizes these comparisons.

11 237. Table 13 summarizes all noninstream current and future uses, reasonable uses,
12 and practical alternatives for diverted Na Wai `Ehā surface waters.

13 14 **4. Economic Impacts**

15 238. In order to assess the economic impacts on users of diverted waters, the flows that
16 will be retained in the streams under the amended IIFS have to be identified first, then the
17 amount of water available for offstream uses, then the shortfalls in those amounts
18 compared to reasonable uses less practical alternatives, and finally, the economic
19 consequences of those shortfalls. However, the evidence at this CCH of the economic
20 impacts consisted primarily of "all-or-nothing" consequences; for example, if no water
21 were available for HC&S's sugar operations. As stated earlier, a more useful analysis by
22 either or both parties would have been the effects on the approximately 5,000 acres of
23 incremental reductions of Nā Wai `Ehā waters. Some of the considerations on the
24 possible economic impacts are as follows:

25 239. All offstream users are subject to the inherent variability of daily stream flows. In
26 extended dry periods, there may not be enough water to meet the needs of all offstream
27 users, and in extremely wet periods, unrestrained diversions may even harm such uses
28 through damage to the ditches and reservoirs and even the end uses. The daily variability
29 of available water will continue, but management of the available water will become
30 more complicated and at times perhaps even unmanageable, because under the current
31 rule of law, the IIFS has to be established first, and only then will the remaining water be

1 available for offstream uses. This means, for example, under current diversion practices,
2 if there were 10 mgd flowing in the stream during dry periods, offstream users could take
3 all 10 mgd, leaving the streams dry below the diversions most of the time and all of the
4 time during dry periods. Under the amended IIFS, if that IIFS were established at 5 mgd,
5 offstream users could divert that much less and none at all if the stream flow were 5 mgd
6 or less.

7 240. The Commission arrives at the following conclusions on the economic impact of
8 restricting offstream uses and provides further analyses in the following sections in which
9 the amended IIFS are established:

10 a. There will be economic consequences to kuleana lands, if the amended
11 IIFS are established at such levels that existing uses and recognized appurtenant rights,
12 whether exercised for traditional and customary or commercial purposes, cannot be
13 practiced because of shortages in available water. But these consequences will not be
14 apparent: 1) until the amended IIFS are established, and 2) if the amended IIFS result in
15 water shortages, how these kuleana lands will fare in the priority-setting among water use
16 permittees under the shortage provisions. Traditional and customary practices, including
17 appurtenant rights, are public trust purposes, and if appurtenant rights are not exercised
18 for traditional and customary purposes, the exercise of appurtenant rights still have a
19 higher priority over private commercial uses. COL 21-24, *supra*.

20 b. The potential impact on MDWS's use of surface waters is similar to that
21 on kuleana lands. At least the majority of MDWS's uses are for "domestic uses of the
22 general public," another public trust purpose. COL 13, *supra*. An additional economic
23 impact on MDWS might be the costs of acquiring the primary distribution systems of
24 WWC (and HC&S's), if one of the consequences of the amended IIFS is that WWC
25 decides to no longer continue its water distribution operations, and Maui County decides
26 that it is in the public interest of the County's citizens to acquire and operate it.

27 c. The economic consequences for WWC's Water Delivery Agreements
28 would primarily be the extra costs, if any, of having to use other delivery systems, such
29 as MDWS's. Furthermore, the largest current and potential users may determine through
30 financial analyses that the better option is to forego their operations (the golf courses),
31 with lost-opportunity costs associated with those decisions. Finally, the Commission has

1 the authority to treat golf-course irrigation as a non-agricultural use and apply different
2 standards and conditions than to agricultural use, which would be of relevance if the
3 Commission issues permits under shortage conditions. **Waiāhole I**, 94 Haw. at 169, 9
4 P.3d at 481.

5 d. The economic consequences on WWC itself would be a direct correlation
6 between reductions of water available for offstream use and its revenues to deliver those
7 waters, or even cessation of its operations altogether. COL 128-133, 135, *supra*.

8 e. The economic consequences for HC&S are threats to its ability to apply
9 economies of scale to its overall 35,000 acres of sugar operations, of which the 5,300
10 acres in West Maui are its most productive; retaining a reasonable cost structure;
11 achieving target sugar yields of 13-14 tons per acre per crop cycle; and returning to
12 historical rates of harvesting; all of which are dependent on a reliable water supply. COL
13 137-142, *supra*. Additional costs and constraints on the power to run the pumps on a
14 consistent and sustained basis because of HC&S's power contract with MECO would be
15 incurred for replacing 9.5 mgd of surface waters by ground water from Pump No. 7. COL
16 105-106, *supra*.

17
18 **b. Amendments to the IIFS**

19
20 **1. Proposed IIFS and the Commission's Range of Choices**

21 241. The current IIFS for the Nā Wai `Ehā streams are the flows that were in the
22 streams on December 10, 1988: "that amount of water flowing in each stream on the
23 effective date of this standard, and as that flow may naturally vary throughout the year
24 and from year to year without further amounts of water being diverted offstream through
25 new or expanded diversions, and under the stream conditions existing on the effective
26 date of the standard." HAR §13-169-48. COL 155, *supra*.

27 242. Those flows must be assigned specific numbers, and the problems inherent in that
28 exercise have already been identified previously: i.e., actual measurements for only
29 Waihe`e River and `Īao Stream, covering the period 1984 to 2005, and only estimates of
30 the ungauged flows for Waiehu and Waikapū Streams through "record-extension
31 techniques" from measurements of stream flows from 1911-1917 and 1910-1917,

1 respectively. COL 157-160, *supra*. These are the only flow estimates above all diversions
2 and the necessary starting points for amending the IIFS, but establishing IIFS at points
3 below the diversions will incorporate any errors in the above-diversion estimates. Further
4 complicating this task is that stream flows in Hawai`i have decreased significantly over
5 the past 90 years, and over the period 1984 to 2007 (blanketing the period, 1984 to 2005,
6 on which the USGS estimates of stream flow are based), there have been a 25 percent
7 reduction of average stream flows in Waihe`e River, a 10 percent reduction in `Iao
8 Stream, and presumed reductions of unknown percentages in the ungauged Waiehu and
9 Waikapū Streams. COL 161, *supra*.

10 243. Based on its review of expert testimony in this contested case hearing, COL 166-
11 169, *supra*, the Commission concludes that establishing continuous stream flow from
12 mauka to makai provides the best conditions for re-establishing the ecological and
13 biological health of the waters of Nā Wai `Ehā. The Commission also cautions that flow
14 restoration cannot make up for the many factors that have affected these streams, but
15 flow restoration is the instrument available to the Commission.

16 244. The Commission also notes that the first amounts of increased flow in dry or very
17 low-flow streams quickly result in large increases in wetted habitat, and that the increase
18 in wetted habitat from further increases in flows becomes less dramatic. FOF 589.

19 245. The Commission has also evaluated the restorative potentials of the Na Wai `Ehā
20 streams and has concluded that the restorative potentials are highest for Waihe`e River
21 and Waiehu Stream. `Iao Stream can be restored to enhance recruitment and increase
22 stream life, but its reproductive potential is severely limited because of extensive
23 channelization in the 2.5 miles immediately above its mouth. Waikapū Stream likely has
24 minimal to no reproductive potential, because there probably was no pre-diversion
25 continuous flow to the mouth, and even if there had been continuous flow, Kealia Pond
26 and the delta below most likely inhibited recruitment. COL 205-217, *supra*.

27 246. After reviewing competing expert opinions on amending the IIFS, COL 166-169,
28 *supra*, and reviewing and rejecting the parties' proposed IIFS, COL 170-201, *supra*, the
29 Commission concludes that one of the three controlled releases proposed by USGS offers
30 the best approach. FOF 611-617. These flows were chosen to correspond to specified
31 flows at the stream mouths, after adjusting for losses into the stream beds in the lower

1 reaches of each stream. Table 14 summarizes the proposed releases by stream flows and
2 total flows. For example, the 1st phase flow would be: 1) Waihe`e River: 10.0 mgd just
3 downstream of the Spreckels Ditch, corresponding to 6.5 mgd at the mouth; 2) Waiehu
4 Stream: 1.6 mgd on North Waiehu below the North Waiehu Ditch and 0.9 mgd on South
5 Waiehu below the Spreckels Ditch, corresponding to 0.6 mgd at the mouth; and 3) `Iao
6 Stream: 9.5 mgd below the `Iao-Maniania Ditch, corresponding to 3.2 mgd at the mouth.
7 Total flow would equal 22.0 mgd. The 2nd and 3rd phase flows would total 36.5 mgd and
8 56.5 mgd.

9
10 **2. Balancing Instream Values and Noninstream Uses**

11 247. The irrigation requirements for HC&S's fields were based on the 80% probability
12 of Table 11 as representing the average requirements over time, or 5958 gad for the
13 Waihe`e-Hopoi Fields and 5408 gad for the `Iao-Waikapū Fields; but as also shown in
14 Table 11, requirements range from a minimum of 4422 gad to a maximum of 6305 gad
15 for the Waihe`e-Hopoi Fields and from 3830 gad to 5836 gad for the `Iao-Waikapū Fields.
16 The balancing between instream values and noninstream uses must not only evaluate that
17 balance when average uses are considered but also what that balance might be at the high
18 end of irrigation requirements.

19 248. Table 15 summarizes the average, median, and 90%-maximum requirements for
20 the reasonable uses summarized in table 13. In table 15, the practical alternatives for the
21 kuleana lands and for WWC uses, a total of 3.17 mgd, have been subtracted from total
22 reasonable uses of 41.09 mgd, resulting in a net reasonable use of 37.92 mgd. The 9.5
23 mgd in practical alternatives for HC&S from Well No. 7 will be subtracted in the
24 following analysis, because it is an alternative that most likely would not be available on
25 a daily basis throughout the year. FOF 500, COL 106, *supra*. The average requirements
26 would total 37.92 mgd. The median requirement of 36.10 mgd is that amount where half
27 of the time, requirements are higher, and half of the time, lower. The 90%-maximum
28 requirements of 38.74-39.66 mgd are the amounts that would be required in the 10
29 percent of the time when requirements would be at their highest.

30 249. Stream flows rise with rainfall and irrigation requirements drop with rainfall, and
31 stream flows drop and irrigation requirements rise when rainfall decreases. The Q₅₀ flow

1 of a stream is that amount where half of the time flows are lower, and half of the time,
2 flows are higher. Therefore, irrigation requirements would be at about the median level
3 when flows are at Q_{50} . It would also be reasonable to expect that irrigation requirements
4 would be at about the 90%-maximum levels when stream flows are only at Q_{90} levels.
5 While these correlations between stream flows and irrigation requirements may not be
6 precise, they provide a method of evaluating whether or not irrigation requirements will
7 be met when stream flows decrease and irrigation requirements increase.

8 250. In table 16, Q_{50} flows and the controlled releases for Waihe'e River and Waiehu
9 Stream, COL 245-246, *supra*, are compared to see whether or not irrigation requirements,
10 assumed to be at their median levels, will be met. With the 1st phase flow total of 12.5
11 mgd, 58.8 mgd would be available for offstream use after subtracting from the Q_{50} flow
12 of 71.3 mgd. Compared with a median requirement of 36.10 mgd, requirements would be
13 met half of the time even without the practical alternative of 9.5 mgd.

14 251. With the 2nd phase flow total of 20.5 mgd, 50.8 mgd would be available. Median
15 requirements of 36.10 mgd would still be met half of the time, without using the 9.5 mgd
16 in practical alternatives but would not be met for a significant portion of the rest of the
17 time without the practicable alternative.

18 252. With the 3rd phase flow of 49.3 mgd, only 22.10 mgd would be available, which
19 would not meet requirements even at Q_{50} even if all 9.5 mgd of practical alternatives
20 were utilized.

21 253. Similar analyses are summarized in Table 17 for Q_{90} flows and 90%-maximum
22 irrigation requirements. Only the 1st phase flow would leave enough water for offstream
23 use, but only if all 9.5 mgd of Well No. 7's practical alternative were used.

24 254. Therefore, adopting the 1st phase controlled flows for the IIFS would provide the
25 best balance between instream values and offstream uses. Moreover, as Well No. 7's 9.5
26 mgd would not be a reliable source throughout the year, FOF 500, COL 106, *supra*, its
27 use would be limited to periods when stream flows above the 12.5 mgd set aside for the
28 IIFS are not adequate to meet offstream requirements.

29 255. The economic impact of restricting noninstream uses would not apply to water
30 being used in an unreasonable manner. COL 11, 42, *supra*. Thus, any economic impact
31 from reducing actual use to reasonable use will not be recognized in the balancing of

1 instream values and offstream uses. Therefore, any costs associated with reductions from
2 current/future uses to reasonable-beneficial uses for WWC's and HC&S's uses and losses
3 (table 13) are not part of the economic impact of restricting noninstream uses. The
4 burden is upon those users to address and remedy system losses and prompt action will
5 enable them to maximize the full benefits of authorized diversions. This is no simple
6 burden, as HC&S is being required to remedy the full system loss from Waiale Reservoir
7 plus half the system loss from extensive ditch and reservoir systems, estimated at 7 mgd-
8 10 mgd and WWC to remedy an estimated 2 mgd loss.

9 256. The economic impact of using practical alternative water sources is intrinsic to the
10 definition of "reasonable-beneficial" use and therefore would not be included in the
11 economic impact of restricting such uses. COL 43, *supra*. Thus, the costs of using
12 practical alternatives by MCLT, WWC users, and HC&S (table 13) would not be part of
13 the economic impact of restricting noninstream uses. Additionally, such costs would
14 have to be incurred anyway as part of the water-use permit conditions if such alternatives
15 were found to be practical based on costs, existing technology, and logistics. COL 31,
16 *supra*.

17
18 **c. Conclusions**

19 257. In weighing "the importance of the present or potential instream values with the
20 importance of the present or potential uses of water for noninstream purposes, including
21 the economic impact of restricting such uses," COL 4, *supra*, the Commission's amended
22 IIFS were based on the following conclusions:

23 258. The amended IIFS should not only increase available habitat but also result in
24 continuous stream flows to the mouth.

25 259. Waikapū Stream has most likely not had continuous flow except under flood
26 conditions in the pre-diversion period, and even if it did, Kealia Pond and the delta would
27 further inhibit recruitment. While increasing flows to assess whether or not continuous
28 flows might have existed in the pre-diversion period is not ruled out, such an assessment
29 can be deferred until some future time when the balancing of instream values and
30 offstream uses might be more favorable to such a controlled restoration.

1 260. `Iao Stream's reproductive and full restorative potential is very limited or
2 prohibited entirely due to the extensive channelization of the 2.5 miles of streambed
3 above the mouth and the 20-foot vertical drop.

4 261. The most credible proposals for amending the IIFS are USGS's proposed
5 controlled flows. Of the three proposed phases, the 1st phase, totaling 12.5 mgd and
6 comprised of 10.0 mgd for Waihe'e River, 1.6 mgd for North Waiehu Stream, and 0.9
7 mgd for South Waiehu Stream, provide the best balance between instream values and
8 offstream uses, and are the only viable IIFS when stream flows are low and all available
9 practical alternatives are in use.

10 262. The economic impact of restricting noninstream uses would not apply to water
11 being used in an unreasonable manner, because such uses are not reasonable-beneficial,
12 nor to the costs of practical alternatives, because use of such alternatives is intrinsic to the
13 definition of "reasonable-beneficial."
14

15 **H. WATER USE PERMIT APPLICATIONS ("WUPAs")**

16 263. The WUPAs in this CCH were for high-level diked ground waters: 1) MDWS's
17 Well No. 5332-05 (Kepaniwai Well) for 1.042 mgd; 2) MDWS's Well No. 5332-02 (`Iao
18 Tunnel [Kepaniwai]) for 1.359 mgd; 3) HC&S's Well No. 5330-02 (`Iao Tunnel [Puako])
19 for 0.100 mgd; and 4) five wells for unknown amounts of water: WWC's Wells No.
20 5132-01 (Waikapu Tunnel 1), No. 5132-02 (Waikapu Tunnel 2), No. 5332-01 (Black
21 Gorge Tunnel), No. 5333-01 (`Iao Needle Tunnel 1), and No. 5333-02 (`Iao Needle
22 Tunnel 2). WUPAs for Waikapū Tunnels 1 and 2 were subsequently excluded, because
23 they were not subject to the `Iao ground water management area designation. FOF 17.
24

25 **1. MDWS's WUPAs**

26 264. MDWS's WUPAs for 1.042 mgd for the Kepaniwai Well (Well No. 5332-05) and
27 1.359 mgd for the `Iao Tunnel (Well No. 5332-02) meet all the criteria for a water use
28 permit. FOF 360-367.
29
30
31

1 **2. HC&S's WUPA**

2 265. The application by HC&S for 0.1 mgd from 'Īao Tunnel (Well No. 5330-02)
3 states as the method of measurement: "Water from the Iao Tunnel is measured at the
4 HC&S Spreckels Ditch at Wailuku Gaging Station along with other stream water."
5 HC&S's WUPA, dated February 25, 2004, and received by CWRM on February 27,
6 2004.

7 266. The Wailuku gauging station is located downstream of the South Waiehu
8 Diversion, the intake pipe from HC&S's 'Īao Tunnel, and the 'Īao Stream intake, none of
9 which is separately gauged. In addition to these three sources, the gauged amount
10 includes water diverted by WWC from Waihe`e River via two Ditches: 1) the Waihe`e
11 Ditch via the drop ditch to Spreckels Ditch; and 2) the Spreckels Ditch Diversion on
12 Waihe`e River. FOF 190.

13 267. According to HRS §174C-50(e) Existing uses: "The commission shall also issue
14 an interim permit for an estimated, initial allocation of water if the quantity of water
15 consumed under the existing use is not immediately verifiable, but the existing use
16 otherwise meets the conditions of subsection (b) for a permit of an interim permit. An
17 interim permit is valid for such time period specified therein. The commission may issue
18 successive interim permits of limited duration." Section 174C-50(g) continues as follows:
19 "If an interim permit is issued pending verification of the actual quantity of water being
20 consumed under the existing use, a final determination of that quantity shall be made
21 within five years of the filing of the application to continue the existing use. In the final
22 determination, the commission may increase or reduce the amount initially granted the
23 permittee."

24 268. Subsection (b) of HRS §174C-50 requires that the existing use be reasonable and
25 beneficial and refers to permits issued in accordance with sections 174C-51 Application
26 for a permit, 174C-52 Notice, and 174C-53(b) Permit Issuance, regarding standing for
27 persons filing objections.

28 269. Regarding the latter subsection on standing of persons filing objections, the
29 parties in this CCH, except for one party that subsequently withdrew, had requested a
30 CCH on all of the high-level, diked ground water sources, which has been combined with
31 the petitions to amend the IIFS for the Nā Wai `Ehā streams. FOF 16-18.

1 270. On the requirement that the use be reasonable and beneficial and the conditions
2 for a permit, HRS §174C-49(a):

3 a) The request can be accommodated with the available source of water. The
4 other existing users, MDWS and WWC, continue to withdraw water and have not
5 objected to HC&S's WUPA.

6 b) The request is for a reasonable-beneficial use. The estimated 0.100 mgd
7 from this ground water source is intermingled with vastly larger amounts of surface water
8 for irrigation of HC&S's Waihe'e-Hopoi Fields. The Code expressly recognizes
9 agriculture as a beneficial use, HRS §174C-2(c), and, for the purpose of this CCH, the
10 Commission has reached conclusions on what are reasonable, economic and efficient
11 uses on these fields: 5958 gad or 21.75 mgd for 3650 irrigated acres, COL 92, *supra*.
12 Whatever amounts of surface waters for which HC&S might be issued water use permits
13 as existing uses by the Commission for these fields in its future actions on a WUPA
14 under the surface water management area designation, such amounts would be reduced
15 by the amount of the ground water from HC&S's 'Īao Tunnel.

16 c) The proposed use does not interfere with any existing legal use of water.
17 The other existing users, MDWS and WWC, continue to do so in the amounts they have
18 been withdrawing prior and up to the designation of the 'Īao aquifer as a ground water
19 management area.

20 d) The proposed agricultural use is consistent with the public interest. Haw.
21 Const. art. XI, § 3; HRS §174C-2(c).

22 e) The lands irrigated by the water HC&S proposes to use are zoned
23 agriculture in the state and county general plans and land use designation and therefore
24 consistent with state and county general plans and land use designations. HRS § 205-4.5;
25 Maui County Code chapters 19.04 and 19.06.

26 f) The proposed use will not interfere with the rights of DHHL, who has not
27 objected to the proposed use.

28 271. Possible practical alternatives are the diverted surface waters that provide the
29 great bulk of irrigation for HC&S's Waihe'e Hopoi Fields, as well as the possible
30 alternatives to those surface waters, FOF 494-506. The diverted surface waters are also a
31 public trust resource, and any future WUPAs for those sources would also require

1 identifying possible practical alternatives. Thus, both are possible practical alternatives to
2 each other and within the Commission’s authority as a matter of law and policy to choose
3 between the two. The high-level diked ground water is the common source for both
4 HC&S’s `Īao Tunnel and the base flows that compose the origins of the Nā Wai `Ehā
5 streams, and it would be more practical to issue a permit for the `Īao Tunnel water and
6 offset the amount of future permits for the surface waters, if any, by that amount, rather
7 than to require HC&S to seal the tunnel and add the amount previously flowing into the
8 Spreckels Ditch to any future permits for surface waters. As for the other possible
9 alternatives identified in FOF 494-506, the final determination of whether they are
10 practical or not will be made in the decisions on the surface water WUPAs. If some or all
11 of those possible alternatives are found to be practical by the Commission, the amounts
12 of surface waters that meet the conditions for a permit will be reduced by the amounts of
13 alternative sources that have been found to be practical alternatives.

14
15 **3. WWC’s WUPAs**

16 272. WWC’s WUPAs are for unknown amounts of water for No. 5332-01 (Black
17 Gorge Tunnel), No. 5333-01 (`Īao Needle Tunnel 1), and No. 5333-02 (`Īao Needle
18 Tunnel 2). FOF 17.

19 273. Black Gorge Tunnel and `Īao Needle Tunnels No. 1 and No. 2 discharge into `Īao
20 Stream above all diversions (See Figure 3). Development of the `Īao Tunnel (Well No.
21 5332-02) caused the Black Gorge Tunnel to go dry. There is no information available to
22 quantify the effects of `Īao Needle Tunnels No. 1 and No. 2 on `Īao Stream’s total flow.
23 FOF 148.

24 274. As with HC&S’s WUPA for `Īao Tunnel (Well No. 5330-02), the Commission
25 could entertain issuing an interim permit, but WWC describes the amounts as “current
26 and historical amounts delivered from those tunnels to the Iao Stream,” WWC Proposed
27 FOF 880. For an interim permit, the Code requires “an estimated, initial allocation of
28 water if the quantity of water consumed under the existing use is not immediately
29 verifiable,” and an interim permit is issued “pending verification of the actual quantity of
30 water being consumed under the existing use.” HRS §174C-50(e)&(e). The Commission

1 interprets these provisions as requiring an estimation of the amount, not just a general
2 statement as provided by WWC.

3 275. Furthermore, unlike HC&S's `Īao Tunnel, which discharges offstream into the
4 Spreckels Ditch, WWC's three tunnels discharge into `Īao Stream upstream of all
5 diversions, and whatever amounts of water they discharge have been incorporated into
6 the current IIFS for `Īao Stream. Therefore, even if WWC were able to quantify the
7 amounts discharged by the three tunnels, they are not being used by WWC as separate
8 and distinct sources of water from WWC's surface water diversions of `Īao Stream and
9 do not qualify for water use permits from the high-level, diked ground waters.

10 276. WWC's WUPA for its portion of the `Īao Tunnel (Well No 5332-02) that it shares
11 with MDWS was not complete and not included in this CCH. During the CCH, WWC
12 attempted to amend its WUPA to cover the amount in excess of that used by MDWS, or
13 0.227 mgd. WWC Proposed FOF 830, 878. WWC may file a new-use WUPA for that
14 amount.

1 **III. DECISION AND ORDER**

2
3 **A. THE AMENDED INTERIM INSTREAM FLOW STANDARDS**

4 The current IIFS for Waihe`e River and Waiehu, `Iao, and Waikapū Streams are
5 those adopted by the Commission on October 19, 1988, with an effective date of
6 December 10, 1988, which “shall be the amount of water flowing in each stream on the
7 effective date of this standard, and as that flow may naturally vary throughout the year
8 and from year to year without further amounts of water being diverted offstream through
9 new or expanded diversions, and under the stream conditions existing on the effective
10 date of the standard.” HAR §13-169-48.

11
12 **1. Waihe`e River**

13 The amended IIFS is as follows:

- 14 1) above all diversions at gauging station 16614000 near an altitude
15 of about 605 feet, the flow will remain as designated on December 10,
16 1988, currently estimated by USGS, based on data from 1984-2005, as Q₉₀
17 of 24 mgd, Q₇₀ of 29 mgd, and Q₅₀ of 34 mgd;
18 2) just downstream of the Spreckels Ditch diversion, the flow will be
19 10 mgd, unless the flow at about 605 feet is less, at which time the flow
20 will be the corresponding amount;
21 3) at the mouth of the River, the flow will be the corresponding
22 amount, estimated at 6.0 mgd² when reduced by losses into the streambed
23 that are estimated as averaging 4 mgd, with estimates ranging from 2.1 to
24 5.9 mgd.

25
26 **2. Waiehu Stream**

27 The amended IIFS for North Waiehu Stream is as follows:

- 28 1) above all diversions near an altitude of 880 feet, the flow will
29 remain as designated on December 10, 1988, currently estimated by USGS,

² USGS estimated stream flow at the mouth of 6.5 mgd as corresponding to 10 mgd below the Spreckels Ditch after deducting 4 mgd in losses. Since these numbers are only approximations, stream flow at the mouth has been estimated at 6.0 mgd instead of 6.5 mgd.

1 based on record extension techniques of 1911 to 1917 data projected to
2 1984-2005, as Q₉₀ of 1.4 mgd to 2.7 mgd, Q₇₀ of 2.3 mgd to 2.7 mgd, and
3 Q₅₀ of 3.1 mgd to 3.6 mgd (See Table 9); and

4 2) 1.6 mgd immediately below the North Waiehu Ditch diversion,
5 unless the flow at altitude 880 feet is less, at which time the flow will be
6 the corresponding amount.

7 The amended IIFS for South Waiehu Stream is as follows:

8 1) above all diversions near an altitude of 870 feet, the flow will
9 remain as designated on December 10, 1988, currently estimated by USGS,
10 based on record extension techniques of 1910 to 1917 data projected to
11 1984-2008, as Q₉₀ of 1.3 mgd to 2.0 mgd, Q₇₀ of 1.9 mgd to 2.8 mgd, and
12 Q₅₀ of 2.4 mgd to 4.2 mgd (See Table 9); and

13 2) 0.9 mgd immediately below the Spreckels Ditch diversion, unless
14 the flow at altitude 870 feet is less, at which time the flow will be the
15 corresponding amount.

16 The amended IIFS for the mouth of Waiehu Stream is as follows:

17 1) the corresponding amount, estimated at 0.6 mgd when reduced by
18 estimated losses of 1.3 mgd between the North Waiehu Ditch and the
19 confluence of North and South Waiehu Stream and 0.6 mgd between the
20 confluence of North and South Waiehu Stream and the mouth.

21
22 **3. Īao Stream**

23 The IIFS for Īao Stream will remain as follows:

24 1) above all diversions near an altitude of 780 feet, the flow will
25 remain as designated on December 10, 1988, currently estimated by USGS,
26 on the basis of 22 years of complete records (climate years 1984-2005), as
27 a Q₉₀ flow of 13 mgd; a Q₇₀ flow of 18 mgd; and a Q₅₀ flow of 25 mgd,
28 (See Table 9);

29
30 **4. Waikapū Stream**

31 The IIFS for Waikapū Stream will remain as follows:

1 1) above all diversions near an altitude of 880 feet, the flow will
2 remain as designated on December 10, 1988, currently estimated by USGS,
3 based on record extension techniques of 1911 to 1917 data projected to
4 1984-2005, as Q₉₀ of 3.3 mgd to 4.6 mgd, Q₇₀ of 3.9 mgd to 5.2 mgd, and
5 Q₅₀ of 4.8 mgd to 6.3 mgd (See Table 9);
6

7 The flows established below the diversions may be augmented by the amounts
8 necessary to meet the requirements of future downstream water-use permittees. COL 4,
9 *supra*.

11 **5. Implementation**

12 The Commission staff shall immediately confer with HC&S, WWC, and other
13 relevant parties to establish a timetable for addressing the approximately 12.48 mgd in
14 preventable system losses. The highest priority is leakage from HC&S's unlined Waiale
15 Reservoir. The Commission has found in the past that merely requiring parties to address
16 losses has not resulted in prompt remedying of losses. Accordingly, after some
17 discussion, the Commission has deliberately opted to place the burden and motivation to
18 address loss squarely upon the parties in control of those systems. The IIFS will be
19 implemented as stated below, and the result is that HC&S and WWC will have to
20 aggressively address ~~immediately remedy~~ significant system losses or face far greater
21 reductions in water to meet their needs. In weighing the needs of instream resources and
22 competing offstream uses; changes in stream levels over the past 90 years and changes in
23 aquifer recharge levels; the Commission determined that this was a fair decision.

24 HC&S shall provide to Commission staff monthly groundwater use reports
25 documenting the volume of water pumped from Well No. 7 that include groundwater
26 levels and salinity measurements in order to accurately measure the current sustainable
27 yield from this source which has not been steadily pumped since the time irrigation
28 practices changed.

29 The existing diversions and gates were designed to divert stream flows and cannot
30 control diversions so that specific flow rates remain in the streams. At least the Īao-
31 Waikapū and `Īao-Maniania Ditch diversion also returns stream flows at a point

1 downstream, thereby disrupting stream flows. New diversion infrastructures and new
2 gauges will have to be provided on all four streams. While the IIFS for `Iao and Waikapū
3 Streams are not amended, in the future permitting process, permittees will have to
4 measure or gauge the amounts they are diverting to comply with their permits. Present
5 diversion structures that disrupt stream flows will have to be modified, in order to allow
6 recruitment of stream life past the diversions. This also applies to `Iao and Waikapū
7 Streams, even though their IIFS have not been amended. In the case of `Iao Stream, if a
8 bypass of the 20-foot vertical concrete drop is constructed, there will most likely be
9 recruitment of stream life during high-flow periods when the stream flows continuously.
10 For Waikapū Stream, flash-flood periods when the stream flow may be continuous will
11 be useful to determine if recruitment can occur, despite Kealia Pond and the delta at the
12 mouth.

13 The Commission staff shall confer with the parties and other relevant parties to
14 determine the locations of stream-gauging stations and their estimated costs and possible
15 sources of funding.

16 Installation and maintenance of stream gauges immediately below the main
17 diversions identified in the IIFS shall be the responsibility of the parties doing the
18 diversions, as part of their responsibilities to report on the amount of their diversions and
19 to ensure that the IIFS below their diversions are met. Construction of bypasses of
20 diversions that current disrupt stream flows will also be the responsibility of the diverters.

21 However, the Commission expects action on implementing the IIFS for Waihe`e
22 River and Waiehu Stream to take place immediately, before diversions that disrupt
23 stream flow are modified, so that estimates of streambed losses in the lower reaches can
24 be confirmed or recalculated, and for immediate increases in available habitat. Existing
25 diversions on Waihee River and Waiehu streams that can be easily modified shall
26 complete the necessary changes to implement the IIFS in no less than two months.
27 Existing diversions that require re-engineering shall initiate design for such re-
28 engineering within two months and action within one year. All diverters from these
29 streams shall provide quarterly written progress reports to the Commission until the IIFS
30 is fully implemented and shall report back before the Commission within one year at a
31 public meeting to report on their efforts.

1 Commission staff shall also confer with the Division of Aquatic Resources, Maui
2 County, and other parties to address the vertical impediments in the channelized portion
3 of `Īao Stream, in South Waiehu Stream below the Spreckels Ditch diversion, and at the
4 mouth of Waiehu Stream, in order to develop methods of allowing upstream migration to
5 circumvent these obstacles.

6 From time to time, as determined by the Commission, staff and the parties shall
7 report on the progress of and impediments to implementing the amended IIFS and their
8 impacts on instream values and offstream uses. The deadline for existing-use WUPAs for
9 surface water diversions in the Nā Wai `Ehā surface water management area was April 30,
10 2009, and the subsequent WUPA process should begin to identify the issues concerning
11 the impacts on offstream uses.

12 The amended IIFS were based on the best-available estimates of stream flows,
13 which, in the case of two streams, Waiehu and Waikapū Streams, were derived through
14 record-extension techniques from actual data for the years 1910-1917. Stream flows in
15 Hawai`i have decreased significantly over a 90-year period. Moreover, for Waihe`e River
16 and `Īao Stream, while actual data from 1984-2005 were used, average (or mean)
17 monthly total stream flows for Waihe`e River for the three 8-year periods 1984-1991,
18 1992-1999, and 2000-2007, have been observed to have decreased by about 25 percent.
19 In this same period, `Īao Stream's average monthly stream flows have decreased by 10
20 percent. There are no data for Waiehu and Waikapū Streams during this time period, but
21 it is reasonable to assume that comparable decreases have been occurring in those two
22 streams. Commission staff shall work with federal and state partners, the diverters and
23 other parties to increase the critical scientific data and information relating to the aquatic
24 resources in these streams, particularly in the Waihee River and Waiehu Stream, to study
25 and document the effects of stream restoration.

26 Any party claiming to be negatively impacted as a result of the IIFS shall monitor
27 and document, in cooperation with Commission staff, the impact upon instream or
28 noninstream uses, including economic impacts. Data shall be provided to the
29 Commission staff to substantiate any claims. Likewise, any party claiming that negative
30 impacts are a direct result of actions (i.e., diverting too much water, violating the IIFS)
31 caused by another party, shall monitor and document the impact upon instream or

1 noninstream uses, including economic impacts. Data shall be provided to the
2 Commission staff to substantiate any claims.

3 “Interim instream flow standards are by their nature temporary and subject to
4 change. Consequently, any reliance upon the interim standards shall be at the water user’s
5 own risk.” HAR §13-169-43(b). This decision is based on having weighed the best
6 evidence presently available to the Commission. Therefore, should there be changes to
7 the operational status of HC&S, WWC, or MDWS, or changes to the current water uses
8 as declared by any of the parties to this proceeding, that party shall provide written
9 notification to the Commission. If the Commission determines that there are substantial
10 changes in water needs, the Commission shall reassess the IIFS for the Na Wai `Ehā
11 streams.

12 13 **6. The Commission Has Met Its Public Trust Duties**

14
15 “The State ... shall conserve and protect Hawaii’s ... water ... and shall promote
16 the development and utilization of these resources in a manner consistent with their
17 conservation and in furtherance of the self-sufficiency of the State.”³ “The state water
18 resources trust thus embodies a dual mandate of 1) protection and 2) maximum reasonable
19 and beneficial use.”⁴ “(T)he object is not maximum consumptive use, but rather the most
20 equitable, reasonable and beneficial allocation of state water resources, with full
21 recognition that resource protection also constitutes ‘use.’”⁵ “(R)eason and necessity
22 dictate that the public trust may have to accommodate offstream diversions inconsistent
23 with the mandate of protection, to the unavoidable impairment of public instream uses
24 and values.”⁶ The Commission on Water Resource Management is tasked by state law
25 with the responsibility to “weigh competing public and private water uses on a case-by-
26 case basis, ... accommodating both instream and offstream uses where feasible.”⁷

27

³ Haw. Const., art. XI, § 1.

⁴ In re Water Use Permit Applications, 94 Haw. 97, 451, 9 P.3d 409, 451 (2000) (Waiahole I).

⁵ Waiahole I, 94 Haw. at 140, 9 P.3d at 452.

⁶ Waiahole I, 94 Haw. at 141, 9 P.3d at 453.

⁷ Waiahole I, 94 Haw. at 142, 9 P.3d at 454.

1 Mark Twain’s witticism that “whiskey is for drinking and water is for fighting” is
2 apropos, given the immense task of establishing instream flow standards in regions where
3 there is insufficient surface water to meet the cumulative needs of resources and uses.

4 The Commission in the instant case followed the mandates of the law as described
5 in the Constitution, state statutes and the Hawaii Supreme Court decisions. The
6 deliberative process was long, involved much debate, discussion and review of the
7 record. At the end of the deliberative process, Commissioners reached agreement on
8 instream flow standards which the majority felt represented the best balance of the
9 mandated values and trust responsibilities.

10 It is unfortunate that Commissioner Miike has chosen to portray the majority
11 decision as a failure of our duties as trustees of the state’s public water resources. As in
12 any difficult decision, reasonable minds may reach different conclusions. Indeed, this
13 very fact is likely the reason the law places the responsibility to establish minimum
14 stream flows upon a Commission of seven, rather than upon one individual. The majority
15 of Commissioners have respected the varying opinions within the Commission in
16 reaching our decision, including Commissioner Miike’s opinion. We will continue to
17 respect those differences despite the allegations in the dissent, and merely say the dissent
18 does not accurately reflect the deliberative process or the basis for the majority decision.

19 On another issue, the Commission is sensitive to the fact that over the course of
20 the past two years we have established IIFS in 28 streams in east Maui and are now
21 establishing IIFS in four streams in west Maui using two very different procedures which
22 may confuse casual observers. Accordingly, a brief explanation of the differences
23 between the east Maui proceedings and the Na Wai Eha contested case hearing process is
24 warranted given the high public interest in both matters.

25 The first significant distinction between Na Wai Eha and east Maui is the
26 jurisdiction of the Commission over the use of surface water diverted from the streams.
27 Na Wai Eha is a surface water management area, whereas east Maui is not. The
28 Commission has far broader authority over diversions of stream waters in a surface water
29 management area.

30

1 The four streams of Na Wai Eha were designated by the Commission as a surface
2 water management area in April 2008. This is the first, and only, designated surface
3 water management area in the State. The effect of the designation is that entities who are
4 currently diverting water from these streams must obtain existing use permits in order to
5 continue any diversion from these streams after the IIFS is established. The Commission
6 is the entity which will review these water use permit applications (WUPA). Applicants
7 must show that their offstream uses are reasonable and beneficial and that there are no
8 practical alternative resources. In other words, existing diverters do not have a continued
9 right to divert waters even if the volume of the diversion is below the minimum levels of
10 water mandated to remain in the stream under the IIFS.

11 In the east Maui situation, the streams are not designated surface water
12 management areas. Accordingly, parties with existing diversions may continue their
13 diversions without additional review by the Commission, provided the minimum stream
14 flow levels established by the IIFS are met even with the diversions. Due to this fact, in
15 east Maui the Commission placed a series of general conditions in its decision to ensure
16 that the Commission will have improved data regarding stream flows and diversions,
17 diverted water will be used responsibly, and that there is transparency and accountability
18 of the end use of all diverted water.

19 In Na Wai Eha, the Commission made a collective finding on the reasonableness
20 of the noninstream uses in order to weigh instream and noninstream uses to establish the
21 IIFS. The Commission did not make the final determination of the amounts of
22 noninstream uses that meet the statutory requirements for water use permits, as that will
23 be done through the WUPA process. Accordingly, in the WUPA process the
24 Commission will determine if particular offstream uses warrant permits to divert stream
25 waters and the conditions that shall be placed upon such diversions in order to ensure
26 responsible water use and accountability of this public trust resource.

27 While some parties and even the hearings officer appeared focused on one user
28 almost to the exclusion of all other matters, some Commissioners were troubled by
29 broader water issues in the region that need to be addressed, including: the County taking
30 responsibility to reduce reliance upon stream waters; the need to obtain improved data on
31 stream flows and restoration benefits; changes in aquifer recharge levels; WWC's

1 transition from agriculture; and the use of a scarce resource for golf course irrigation.
2 These issues will be addressed by the Commission in the subsequent WUPAs from the
3 continuing diverters as well as from parties seeking new diversions.

4 The second significant distinction between Na Wai Eha and east Maui is the
5 process by which the Commission established the IIFS. In Na Wai Eha the Commission
6 established the IIFS through an adversarial, contested case procedure, whereas the IIFS in
7 east Maui was established through the Commission's normal course of business in a
8 quasi-legislative process. Future Commissions should take note of the distinction
9 between the two procedures and make a conscious decision which to use in future IIFS
10 proceedings. The choice of which process to use is up to the Commission when acting
11 upon a petition to amend IIFS.

12 In Na Wai Eha, the Commission opted to place the petition to amend IIFS into a
13 contested case proceeding. That immediately meant the entire process was conducted
14 similar to a trial, with lawyers, expert and other witnesses in an adversarial proceeding
15 wherein only admitted parties and their witnesses have the opportunity to testify, all of
16 which is overseen by a hearings officer. The hearings officer issues a draft decision,
17 which is reviewed by the Commission, which is responsible for the final decision.
18 During the entire contested case procedure, the Commission acts similar to a judge in
19 court. Commissioners are barred from speaking with outside persons about the case,
20 must deliberate among themselves in private, may only consider the evidence in the
21 record from the hearing, and issue a final decision and order without public hearing.

22 Conversely, in reviewing the east Maui petitions, the Commission opted to review
23 the petitions to amend IIFS in the same manner in which it ordinarily conducts business,
24 through a quasi-legislative process. In quasi-legislative proceedings the Commission acts
25 similar to a legislature. Commission staff works directly with petitioners, diverters of
26 water and the general public to obtain information, conduct site visits and studies, hold
27 public hearings to gather testimony, and develop recommendations for the Commission.
28 Commissioners conduct site visits to the streams, view adjacent stream uses, diversion
29 systems and offstream uses, all with public participation. Commissioners hold multiple
30 public hearings at which they directly hear testimony from anyone, may only deliberate
31 in public, and issue a final decision in a public meeting.

1 The quasi-legislative process used in east Maui certainly demanded a lot more
2 time from Commissioners and staff. However, from the viewpoint of Commission, there
3 is a great deal of value in being able to hear testimony from the public and to be able to
4 question and continue gathering information for consideration up to the decision point.
5 From the viewpoint of the public, the quasi-legislative process provides a more inclusive
6 and transparent deliberative process which fosters accountable and responsive
7 government.

8 Hawaii has been fortunate compared to many regions around the world in that we
9 have abundant sources of clean water. However, these resources are not infinite, and due
10 to changing weather patterns and demands, in many parts of our state we have reached or
11 exceeded the capacity of existing water resources. Over the past half a century stream
12 flows have dropped considerably due to changing weather patterns; our state has
13 experienced significant drought this past decade; with the exception of Oahu our County
14 water systems are not integrated and development has strained convenient sources and is
15 not necessarily near additional groundwater sources. Easy reclamation and reuse has
16 been accomplished, but the infrastructure investments to develop new and larger
17 alternative sources and recycling is daunting to local government. The practice of
18 passing the responsibility to develop water onto the private sector has the unintended
19 consequence of fueling higher-cost development, which may not address the broader
20 public demand for workforce housing, public facilities and open space, and food
21 sustainability.

22 The Commission’s role in both Na Wai Eha and east Maui is immediately focused
23 on the narrow issue of minimum stream flows. However, due to the convergence of the
24 above-referenced circumstances, the Commission is also issuing a decision which forces
25 all parties to address critical water issues which have been avoided for far too long.
26 Diverters, including the County, will need to invest in water systems and infrastructure to
27 increase effective use and conservation of water. Larger diverters facing ongoing and
28 growing needs, including the County, should explore joint development of reclamation
29 and water recycling in order to address their needs without returning to these streams.

30

1 The Commission should continue establishing IIFS across the state to foster
2 improved management of Hawaii’s water resources. The quasi-legislative process used
3 in east Maui created a template for a non-adversarial process which requires all parties to
4 wisely manage this precious resource island-style – where we recognize our
5 interdependence and the needs of our resources and our people – and we make the hard
6 decisions that are necessary. Given growing populations, changing weather patterns, and
7 critical resource and policy needs, we need more responsive and nimble water decisions
8 and less decades-long litigation over a few isolated cases.

9 The Commission did meet its public trust responsibilities in Na Wai Eha.

10
11 **B. WATER USE PERMIT APPLICATIONS FOR DIKED, HIGH-LEVEL**
12 **WELL AND TUNNEL SOURCES**

13
14 **1. MDWS**

15 MDWS is awarded water use permits for the existing use of 1.042 mgd for the
16 Kepaniwai Well (Well No. 5332-05) and 1.359 mgd for the ‘Īao Tunnel (Well No. 5332-
17 02), subject to the standard conditions for a ground water permit. (Attachment A.)

18
19
20 **2. HC&S**

21 HC&S is awarded a limited water use permit of 1-year duration for 0.1 mgd from
22 ‘Īao Tunnel (Well No. 5330-02), subject to the standard conditions for a ground water
23 permit. (Attachment A.)

24 HC&S must verify the actual quantity of water being consumed under the existing
25 use. The Commission may continue to issue successive one-year limited water use
26 permits, if the current permits expire before the actual quantity of water being consumed
27 is verified. A final determination shall be made within five years of the filing of HC&S’s
28 WUPA. In the final determination, the Commission may increase or reduce the amount
29 initially granted to HC&S.

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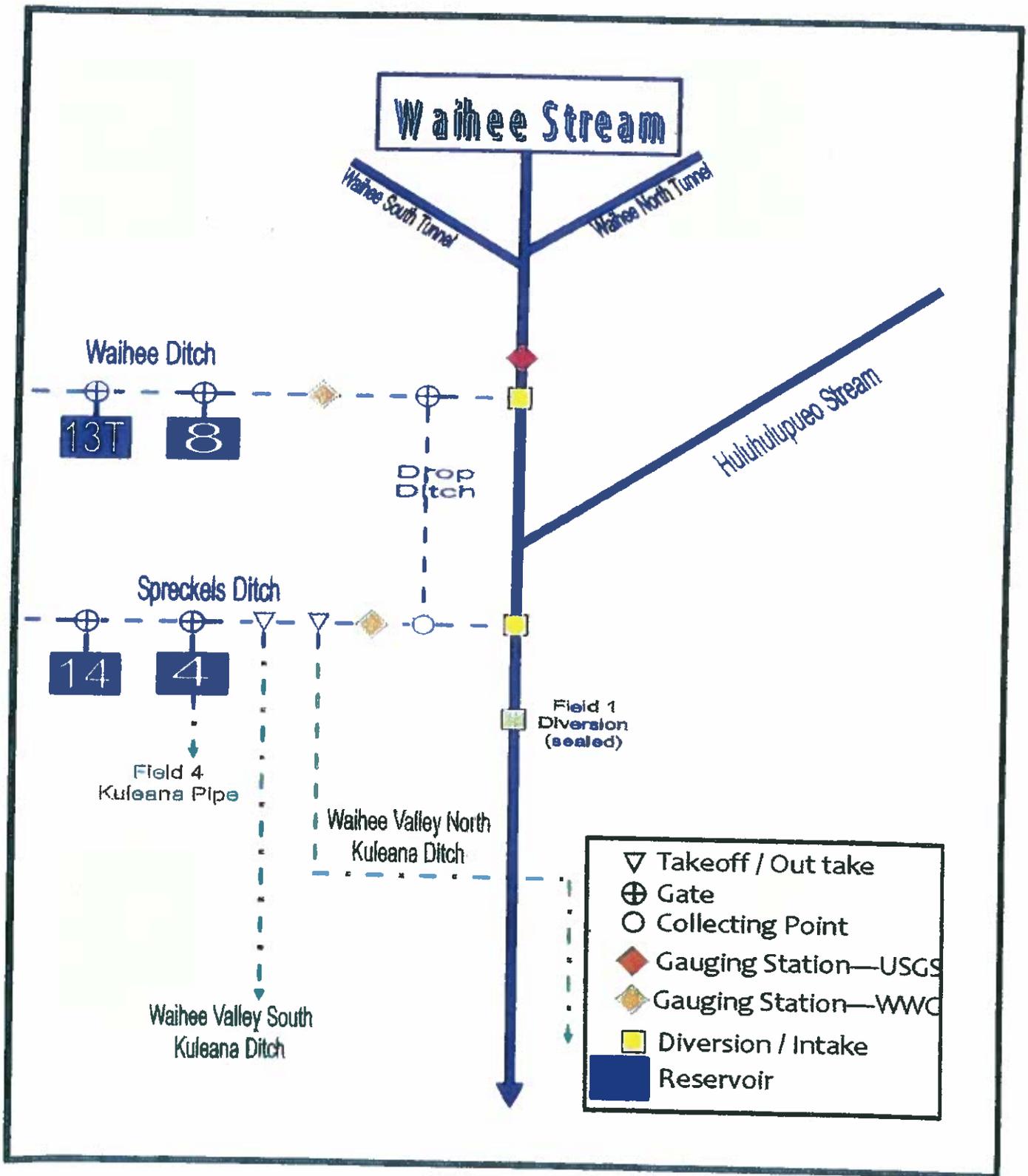
3. WWC

WWC's WUPAs No. 684 (Well No. 5333-01, 'Īao Needle Tunnel 1), No. 686 (Well No. 5333-02, 'Īao Needle Tunnel 2), and No. 685 (Well No. 5332-01, Black Gorge Tunnel) are denied.

These three tunnels discharge into 'Īao Stream upstream of all diversions, and whatever amounts of water they discharge have been incorporated into the current IIFS for 'Īao Stream. Therefore, even if WWC were able to quantify the amounts discharged by the three tunnels, they are not being used by WWC as separate and distinct sources of water from WWC's surface water diversions of 'Īao Stream and do not qualify for water use permits from the high-level, diked ground waters.

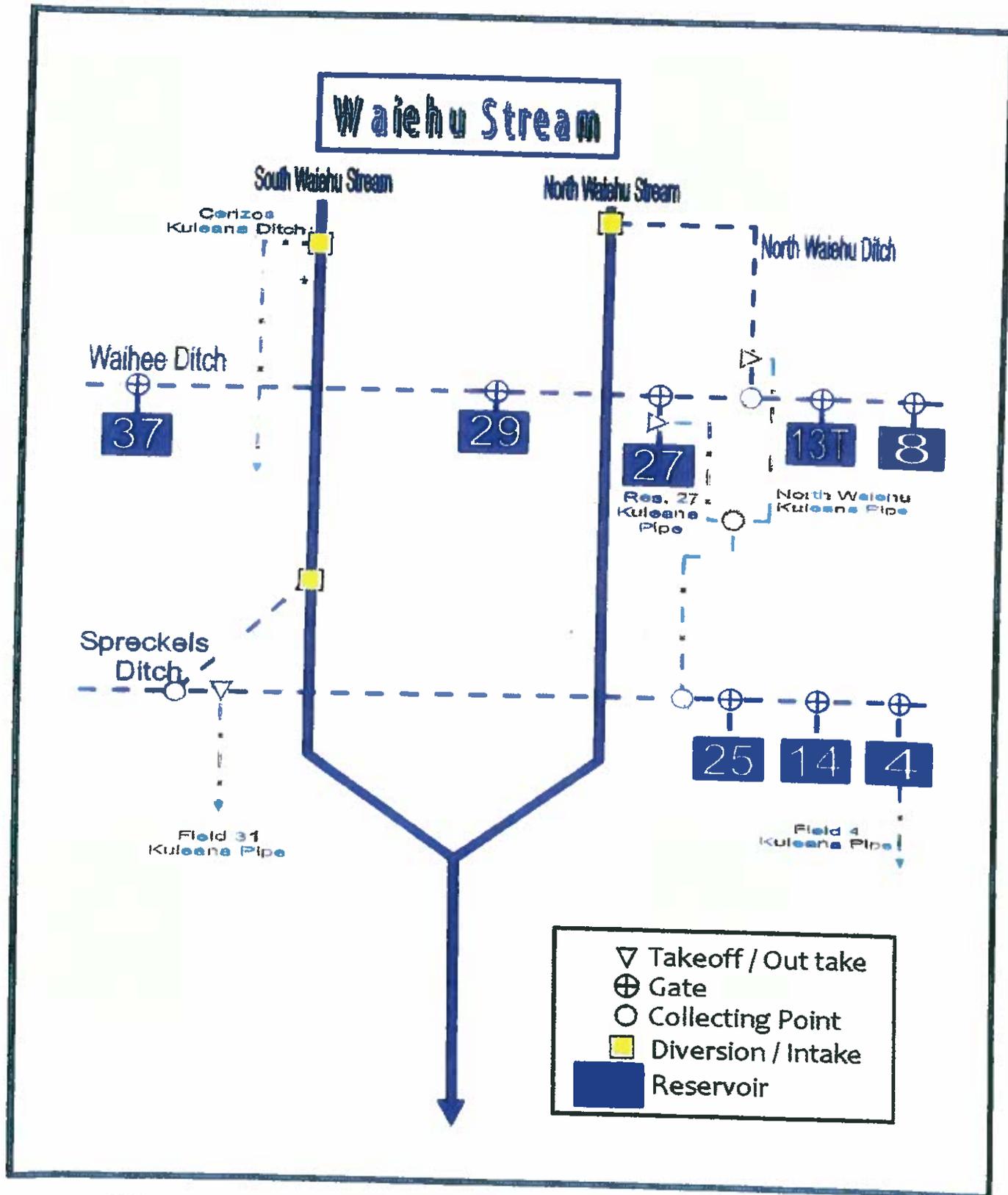
WWC's WUPA for its portion of the 'Īao Tunnel (Well No 5332-02) that it shares with MDWS was not complete and not included in this CCH. During the CCH, WWC attempted to amend its WUPA to cover the amount in excess of that used by MDWS, or 0.227 mgd. WWC may file a new-use WUPA for that amount.

Figure 1: Waihee River and Diversions



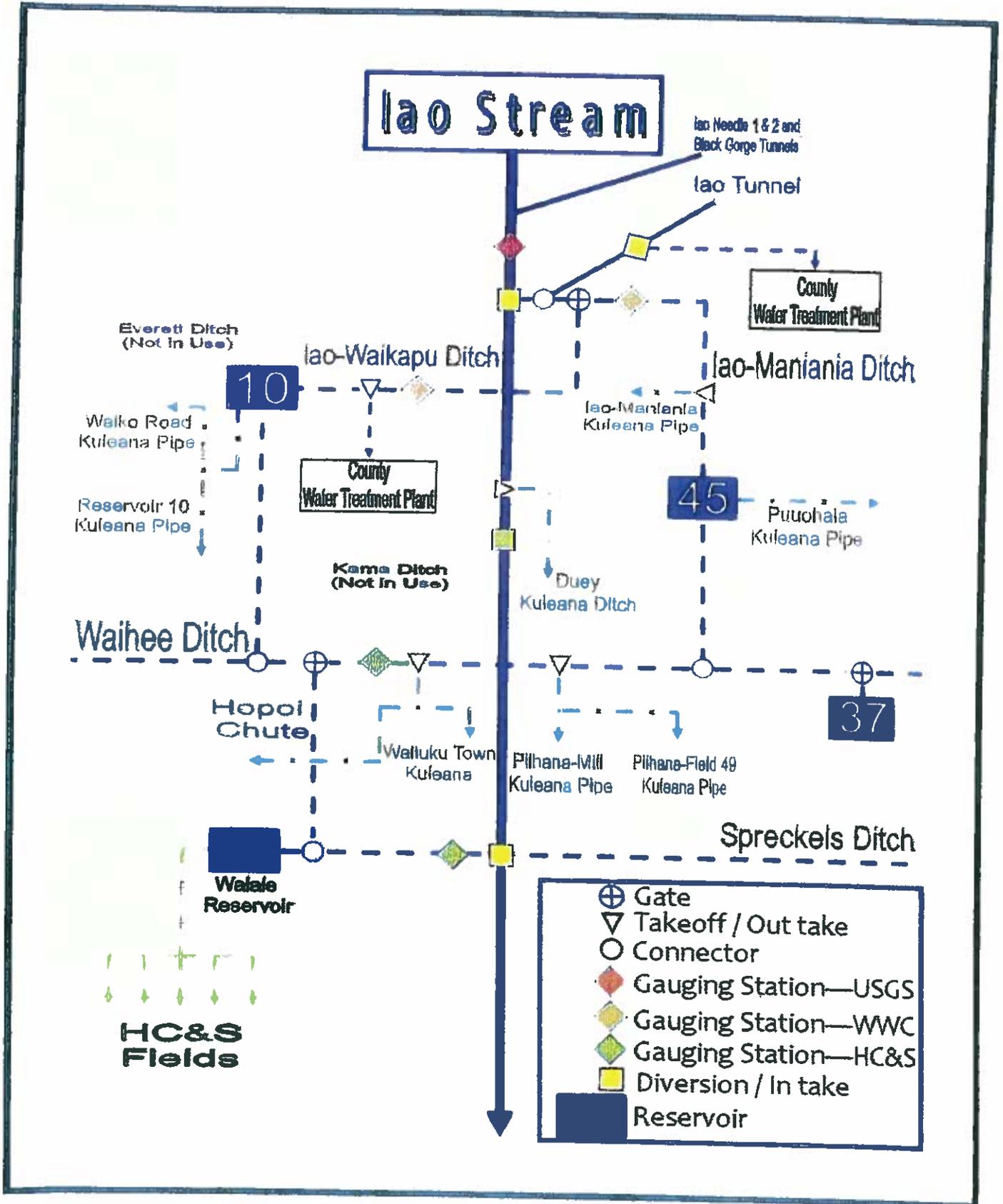
(WVC FOF 351)

Figure 2: Waiehu Stream and Diversions



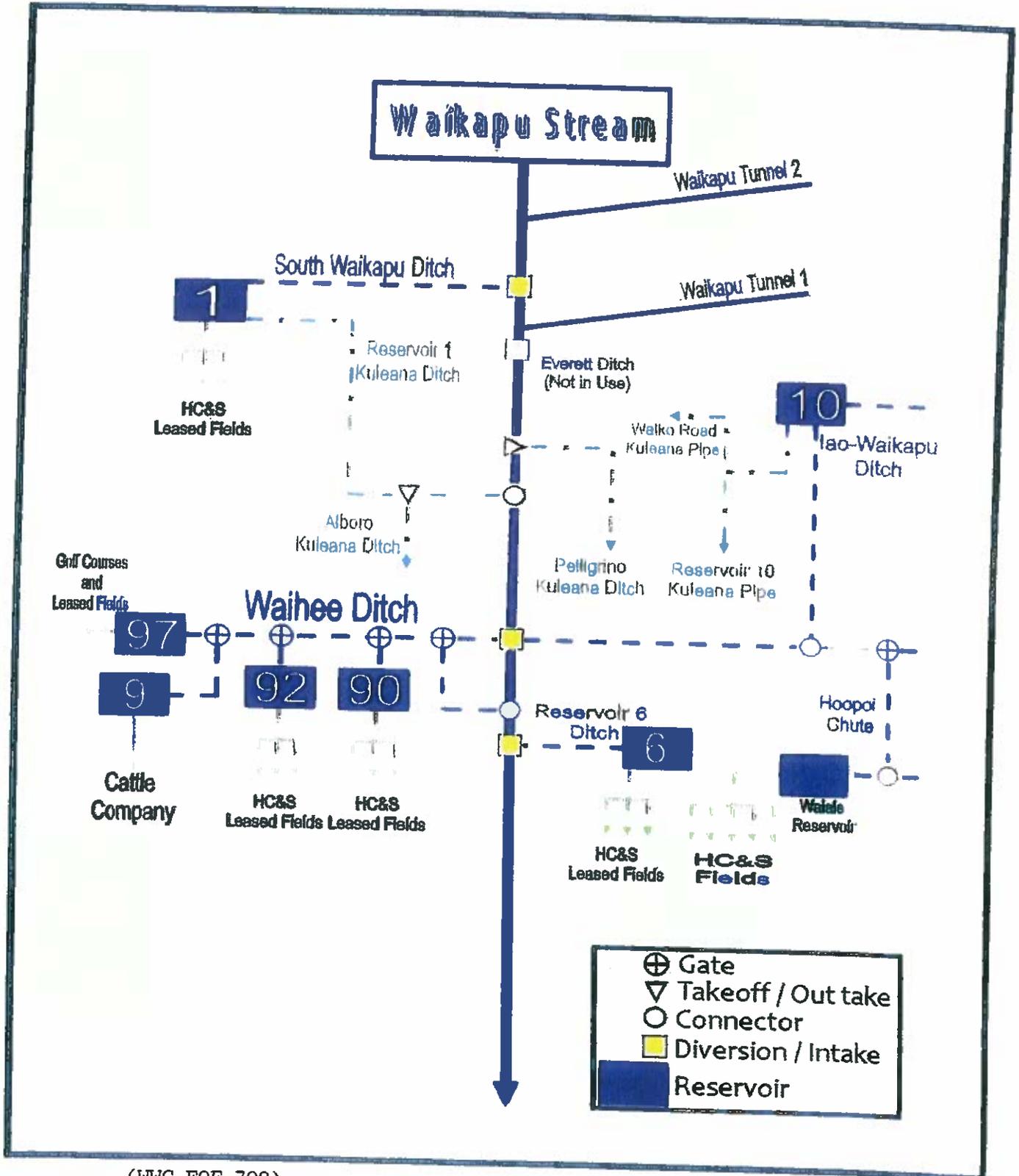
(WVC FOF 609)

Figure 3: Iao Stream and Diversions



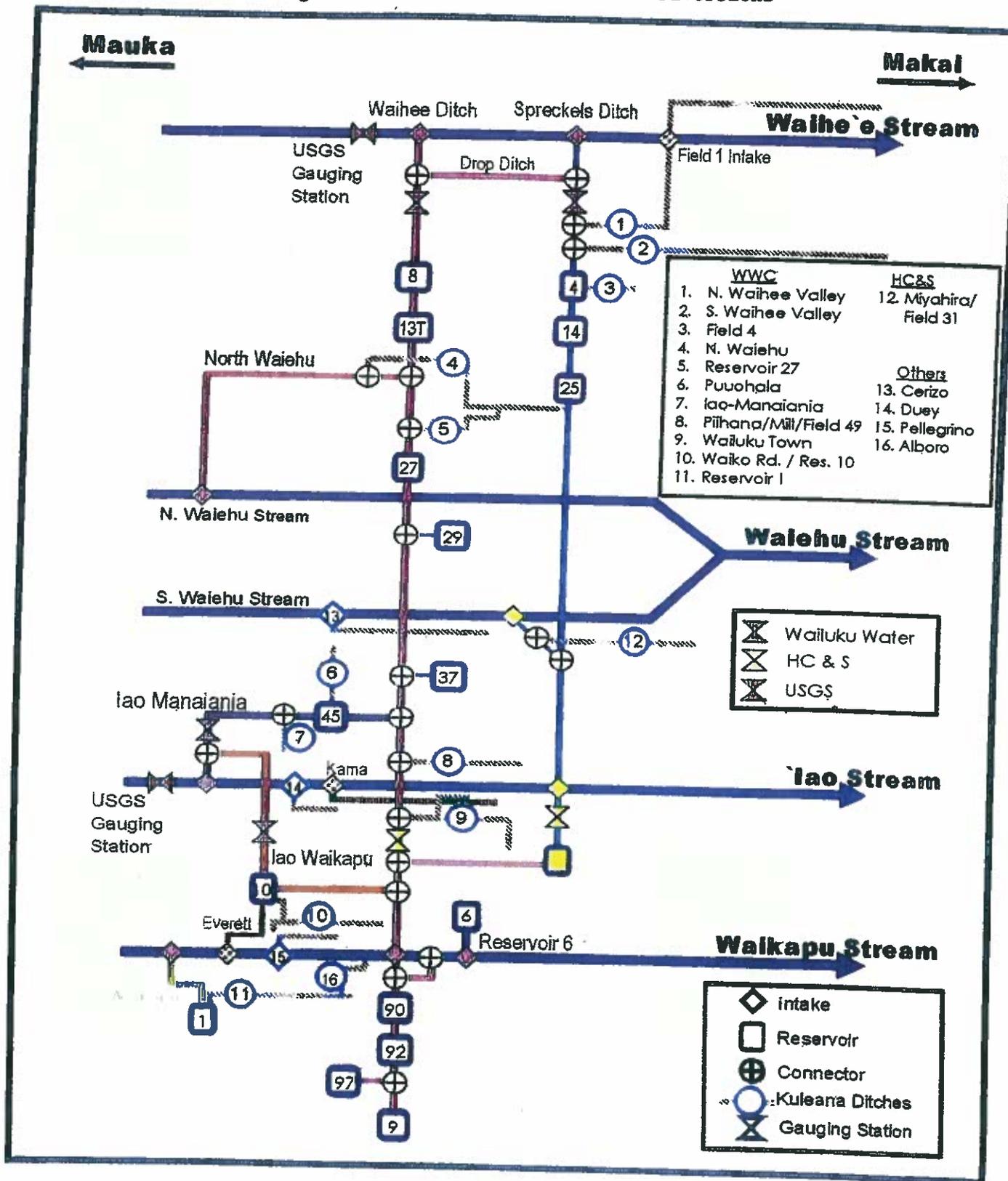
(WWC FOF 476)

Figure 4: Waikapu Stream and Diversions



(WVC FOF 709)

Figure 5: Na Wai Eha Streams and Diversions



(Exhibit D-99). (WWC FOF 78)

Table 1: Kuleana Ditch/Pipe by Stream Source

Kuleana System	Stream Source	Ditch Source	Reservoir Source
Waihe`e Valley North Ditch	Waihe`e	Spreckels	-
Waihe`e Valley South Ditch	Waihe`e	Spreckels	-
Field 4 Pipe	Waihe`e	Spreckels	4
North Waiehu Pipe	North Waiehu	North Waiehu	-
Reservoir 27 Pipe	Waihe`e	Waihe`e	27
Cerizos Ditch	South Waiehu	-	-
Field 31 Pipe	Waihe`e	Spreckels	-
Puuohala Pipe	`Iao	`Iao-Maniania	45
`Iao-Maniania Pipe	`Iao	`Iao-Maniania	-
Piihana-Mill Pipe	Waihe`e/`Iao	Waihe`e/`Iao-Maniania	-
Piihana-Field 49 Pipe	Waihe`e/`Iao	Waihe`e/`Iao-Maniania	-
Duey Ditch	`Iao	-	-
Wailuku Town Ditch	`Iao/Waihe`e	Waihe`e/lao-Maniania	-
Reservoir 10 Pipe	`Iao	`Iao-Waikapū	10
Waiko Road Pipe	`Iao	`Iao-Waikapū	10
Pellegrino Ditch	Waikapū	-	-
Reservoir 1/Alboro Ditch	Waikapū	Waikapū	1

(Exh. D-7; see also Cerizo WDT 9/14/07, Pellegrino WDT 9/14/07, and Duey WDT 9/14/07; Exh. D-99). WWC FOF 152.

Table 2: Water Deliveries by Ditch System, 2006¹

<u>Kuleana System</u>	<u>Delivery Amount</u>
Waihe`e Valley North Ditch	0.95 mgd
Waihe`e Valley South Ditch	2.60 mgd
Field 4 Pipe	0.09 mgd
North Waiehu Pipe	0.16 mgd
Reservoir 27 Pipe	1.35 mgd
Puuohala Pipe	0.01 mgd
ʻĪao-Maniania Pipe	0.06 mgd
Piihana-Mill Pipe	<0.01 mgd
Piihana-Field Pipe	<0.01 mgd
Wailuku Town Ditch	0.04 mgd
Reservoir 10 Pipe	0.06 mgd
Waiko Road Pipe	<0.01 mgd
Reservoir 1 Ditch/Alboro Ditch	0.84 mgd
<hr/>	
Total Deliveries	6.16 mgd ²
<hr/>	

¹Some of the numbers presented in WWC FOF 172 are incorrect, when compared to tables presented for each of the source streams; i.e., compare WWC FOF 172 with WWC FOF 413, 543, 657, and 759.

²Counting deliveries reported by HC&S and Hui/MTF, 6.84 mgd was delivered to kuleana lands. See footnote 2 in Table 7.

(Exh. D-7, Exh. A-213.) WWC FOF 413, 543, 657, 759.

Table 3: Waihe`e River Waters: Ditch and Kuleanas

<u>Kuleana System</u>	<u>Type of Gauge</u>	<u>TMK and Name</u>	
Waihe`e Valley North Ditch	No Gauge	3-2-03:24	Majorie Barrett
		3-2-03:30	Lawrence Koki
		3-2-004:007	Dinnah K.L. Goo
		3-2-004:008	Dinnah K.L. Goo
		3-2-004:009	Dinnah K.L. Goo
		3-2-004:010	Dinnah K.L. Goo
		3-2-04:11	Richard Emoto/Roys Ellis
		3-2-004:012	Roys Ellis
		3-2-04:13	Julia & Stanley Faustino
		3-2-04:14	Nattie Kalanui
		3-2-004:015	Michael Rodrigues
		3-2-004:016	Michael Rodrigues
		3-2-04:017	Nathan Kanae/Michael Rodrigues
		3-2-002:037	William "Ka`u" Freitas
		Waihe`e Valley South Ditch	Weir
3-2-004:003	Kenneth Kahalekai		
3-2-004:018	Kaniloa Kamaunu		
3-2-004:019	Kenneth Kahalekai		
3-2-05:11	Burt Sakata		
3-2-05:15	Burt Sakata		
3-2-05:16	Ronald Nakata		
3-2-05:17	Peter Fritz/Burt Sakata		
3-2-05:20	Lorraine Anakalea		
3-2-05:21	Scott Linden		
3-2-05:22	James & Kenneth Kahalekai		
3-2-05:23	Nalia & Kenneth Kahalekai		
3-2-05:024	Kenneth Kahalekai		

Table 3 (continued): Waihe`e River Waters: Ditch and Kuleanas

<u>Kuleana System</u>	<u>Type of Gauge</u>	<u>TMK and Name</u>	
		3-2-05:025	Kenneth Kahalekai
		3-2-05:027:	Kenneth Kahalekai
		3-2-05:31	Thomas Texeira
		3-2-05:032	Thomas Texeira
		3-2-05:036	Kenneth Kahalekai
		3-2-05:039	Burt Sakata
		3-2-06:001	Charlene Kana
		3-2-06:04	D. Furukawa/Cordell Chang
		3-2-06:10	James Murakami
		3-2-06:18	Jacob & Charlene Kana
		3-2-07:10	Noel Texeira
		3-2-07:16	Bryan Sarasin
		3-2-11:06	Willie & Janet Goo/Dinnah K.L. Goo
		3-2-11:07	James & Barbara Goo/Dinnah K.L. Goo
		3-2-11:19	Jeffrey & Gale Goo/Dinnah K.L. Goo
		3-2-11:65	Lawrence & Diannah Goo/Dinnah K.L. Goo
		3-2-11:66	Joni Kawamura/Ester Goo/Dinnah K.L. Goo
		3-2-11:67	Joni Kawamura/Willie Goo/Dinnah K.L. Goo
Field 4 Pipe	1 ½ inch meter	3-2-07:17	Leonard Kaili/James Kaili, Jr.
		3-2-07:18	Merle Ideoka
		3-2-07:021	Donald Miyashiro/Waihe`e School
Reservoir 27	No Gauge	3-2-18:05	Alex Buttarro
		3-2-18:06	Heinrich Eisenburger
		3-2-18:07	Clarence & Magdalen Hoopi
		3-2-18:09	Donalee Singer
		3-2-18:14	William Morris

Table 3 (continued): Waihe`e River Waters: Ditch and Kuleanas

<u>Kuleana System</u>	<u>Type of Gauge</u>	<u>TMK and Name</u>	
		3-2-18:16	Lester Nakama
		3-2-18:17	David & Donalee Singer
		3-2-18:44	Cook Trust
		3-2-18:45	Louis Silva/Magdalen Hoopi
		3-2-18:46	Louis Silva/Magdalen Hoopi
Piihana – Mill Pipe	3 inch meter	3-4-21:08	Elmer & Naone Ching
		3-4-21:09	Terumi Eya
		3-4-21:37	Robert Fujioka
		3-4-24:22	Alfred & Patricia De Mello/Alfred Santiago
		3-4-24:27	Alson & Vera De Mello Trust/Alfred Santiago
		3-4-25:42	Ronald Kim/Robert Kim
		3-4-33:14	Charles & Judy Dando
Piihana – Field 49 Pipe	1 ½ inch meter	3-4-31:08	Winifred L. Nakoia Cockett
		3-4-31:09	Annie Aola
		3-4-31:10	Gaznen Elizares
		3-4-31:11	Annie Aola
Wailuku Town Ditch/Pipe	4 inch meter	3-4-04:72	Jo Ann Howard
		3-4-04:78	Val & Lianne Ogata
		3-4-07:42	Anne & Vernon J.K. Bal

(Exh. D-7.) WWC FOF 414.

Table 4: North Waiehu Stream Waters: Ditch and Kuleanas

<u>Kuleana System</u>	<u>Type of Gauge</u>	<u>TMK and Name</u>	
North Waiehu Pipe	no gauge	3-2-018:21	William Robinson
		3-2-18:14	Donnalee Singer
		3-2-18:15	Donnalee Singer
		3-2-18:17	Donnalee Singer
		3-2-18:27	Magdalen Hoopii
		3-2-18:31	Magdalen Hoopii
		3-2-18:32	Magdalen Hoopii
		3-2-18:33	Magdalen Hoopii
		3-2-18:34	Donnalee Singer
		3-2-18:40	Kenneth Lee

(Exh. D-7, Hoopii, Tr. 12/4/07, pp. 196-207, Sinter, Tr. 12/13/07, p. 29.) WWC FOF 658.

Table 5: `Iao Stream Waters: Ditch and Kuleanas

<u>Kuleana System</u>	<u>Type of Gauge</u>	<u>TMK and Name</u>	
`Iao-Maniania Pipe	meter	3-3-02:17	Harold Graham
		3-3-02:18	Henry Ito's Orchid & Garden
Puuohala Pipe	meter	3-3-02:03	Valentine Haleakala
		3-3-02:25	Henry Kailiehu
		3-3-02:29	Gary & Evelyn Brito Trust
Waiko Road	meter	3-5-04:14	Avery Chumbley
		3-5-04:18	Avery Chumbley
		3-5-04:57	Glenn McClean
Reservoir 10	meter	3-5-04:38	Harumi Sanamura
		3-5-04:39	Roger Yamaoka
		3-5-04:41	Robert & Claire Pinto
		3-5-04:42	Royal & Earlette Vida
		3-5-04:44	Donald Vida
		3-5-04:51	Robert Pinto
		3-5-04:56	Leslie Vida
		3-5-04:91	Leslie Jr. & Michelle Vida
3-5-04:100	Annie Vida		

(Exh. D-7; Brito, Tr. 12/7/07, pp. 29-38.) WWC FOF 544.

Table 6: Waikapū Stream Waters: Ditch and Kuleanas

<u>Kuleana System</u>	<u>Type of Gauge</u>	<u>TMK and Name</u>	
Reservoir 1	no gauge	3-6-05:19	David Kaliponi/Alfred Santiago through Colin Kaliiponi
		3-6-06:01	Barbara Pawn
		3-6-06:09	Clayton Suzuki Trust
		3-6-06:13	Clayton Suzuki Trust
		3-6-06:17	Barbara Pawn
		3-6-06:21	Mae Balmores/Nadao Makimoto
		3-6-06:22	Sakae & Bernadette Inouye
		3-6-06:24	David Kaliponi/Alfred Santiago through Colin Kaliiponi
		3-6-06:25	Elaine Mullaney/Crystal Alboro
		3-6-06:27	Jinsei & Patricia Miyashiro
		3-6-06:29	Elaine Mullaney/Crystal Alboro
		3-6-06:33	Barbara Pawn
		3-6-06:42	Sharlee Dieguez

(Exh. D-7; Exh. A-194.) WWC FOF 761.

Table 7: Total Water Deliveries To All Users, 2005 and 2006

	<u>2005</u>	<u>2006</u>
HC&S:		
Waiale Reservoir (Waihe`e-Hopoi Fields)	40.11 mgd	31.04 mgd
Leased Fields (`Īao-Waikapū Fields)	9.98 mgd	10.88 mgd
MDWS:		
Surface water: `Īao-Waikapū Ditch	0.71 mgd	1.08 mgd
Groundwater: `Īao Tunnel	1.59 mgd	1.76 mgd
Kuleana System Users	6.84 mgd	6.84 mgd ¹
WWC Delivery Agreements	1.42 mgd	2.37 mgd
Total Use: All Users	60.65 mgd	53.97 mgd
Minus ground water contributions from:		
MDWS's `Īao Tunnel (Well No. 5332-02), and	-1.59 mgd	-1.76 mgd
`Īao Tunnels (Well Numbers 5332-02 and 5330-02) ²	-0.4 mgd	-0.4 mgd
Total Surface Water Use: All Users	58.66 mgd	51.81 mgd
Plus WWC's estimated of 7.34 percent system losses ³	4.31 mgd	3.80 mgd
Total Surface Water Deliveries, including system losses	62.97 mgd	55.61 mgd

¹Compare with Table 2, with total deliveries of 6.16 mgd. Table 7's total of 6.84 mgd includes kuleana diversions not accounted for by WWC but reported by HC&S and Hui/MTF. FOF 227.

²Approximately 0.3 mgd added to the ditch system by WWC from MDWS's `Īao Tunnel (Well No. 5332-02) and 0.1 mgd from HC&S's `Īao Tunnel (Well No. 5330-02). FOF 153-154. **See also** text accompanying Table 7.

³FOF 374.

(Exh. E-3, E-4, and A-138, as modified by FOF 227 for the kuleana users.)

Table 8: Water Diverted by WWC (and HC&S) From Nā Wai `Ehā,
Estimates for 2005 and 2006¹

<u>Diversion Source</u>	<u>2005</u>	<u>2006</u>
Waihe`e River	37.09 mgd	29.72 mgd
Waiehu Stream	1.41 (+3) mgd	1.38 (+3) mgd
`Īao Stream	13.68 (+4) mgd	13.53 (+4) mgd
Waikapū Stream	4.32 mgd	4.31 mgd
<hr/>		
Total: ²	56.50 (+7) mgd	48.94 (+7) mgd

¹Excludes a low of 2-3 mgd during dry periods to a maximum of 10-15 mgd during wet periods diverted by HC&S for South Waiehu Stream; and a low of 3-4 mgd during dry periods to a high of about 20 mgd during wet periods diverted by HC&S for `Īao Stream.

²If we assume HC&S diverts an average of about 3 mgd from South Waiehu Stream and about 4 mgd from `Īao Stream, the total quantity of water diverted from the four streams, 63.50 mgd in 2005 and 55.94 mgd in 2006, approximates the total surface water deliveries, including losses, of 62.97 mgd in 2005 and 55.61 mgd in 2006 in Table 7.

(Exh. A-138, E-3, E-4.)

Table 9: Comparisons of Diversions versus Q Flows (mgd)

	Gate Capacity/Setting ¹	Diversions ²		Q ₉₀ ³	Q ₇₀ ³	Q ₅₀ ³
		2005	2006			
Waihe`e River	90 /52	37.09	29.72	24	29	34
Waiehu Stream						
North Waiehu	5/1.5	1.41	1.38	1.4-2.7	2.3-2.7	3.1-3.6
<u>South Waiehu</u>	no gauge ⁴	<u>3.00</u>	<u>3.00</u>	<u>1.3-2.0</u>	<u>1.9-2.8</u>	<u>2.4-4.2</u>
Subtotal		4.41	4.38	2.7-4.7	4.2-5.5	5.5-7.8
`Iao Stream	60/20	13.68	13.53	13	18	25
no gauge ⁵		<u>4.00</u>	<u>4.00</u>			
Subtotal		17.68	17.53			
Waikapū Stream	<u>5/3</u>	<u>4.32</u>	<u>4.31</u>	<u>3.3-4.6</u>	<u>3.9-5.2</u>	<u>4.8-6.3</u>
Total:	160/76.5 ⁶	63.50	55.94	43-46.3	55.1-57.7	69.3-73.1

¹ FOF 180, 185, 186-187, 193, 195, 199.

² Table 8.

³ FOF 107, 113, 119, 126, 133.

⁴ Not gaged, but HC&S reports diverting 2-3 mgd during dry periods to a maximum of 10-15 mgd during wet periods. FOF 211.

⁵ Not gaged, but HC&S reports diverting a low of 3-4 mgd during dry periods to a high of about 20 mgd during wet periods. FOF 212.

⁶ Gate settings are increased by 35 mgd, because HC&S reports diverting a high of 15 mgd from South Waiehu and 20 mgd from `Iao Streams during wet periods. Therefore, maximum amounts of water that can be diverted by gate settings would be 111.5 mgd: 1) 52 mgd for Waihe`e River; 2) 16.5 mgd for Waiehu Stream; 3) 40 mgd for `Iao Stream; and 4) 3 mgd for Waikapū Stream.

Table 10: Estimates of irrigation requirements¹ by Fares for the Waihe`e-Hopoi and `Iao-Waikapū Fields in gallons per acre per day (gad).

	<u>Median</u>	<u>Minimum</u>	<u>50%</u>	<u>80%²</u>	<u>90%</u>	<u>95%</u>	<u>Maximum</u>
Waihe`e-Hopoi	5323	4211	5317	5674	5834	5953	6005
`Iao-Waikapū	4755	3648	4752	5150	5330	5466	5558

¹If the specified amounts were applied to all acres, the columns denote the percent of acres whose irrigation requirements would have been met during the reference period. “Minimum” refers to the lowest amount of water that would have met requirements for all acres at some time during the reference period, which would have been a small percentage of time for the entire reference period. “Maximum” refers to the amount of water that would have met requirements for all acres during all of the reference period.

²80% probability is the industry standard for satisfying crop irrigation requirements. COL 74; FOF 457.

Source: Exhibit A-80, pp. 6-7, Tables 2 and 3.

Table 11: Irrigation requirements for the Waihe`e-Hopoi and `Iao-Waikapū Fields, calculated as a 5 percent increase over Fares’s estimates¹, in gallons per acre per day (gad).

	<u>Median</u>	<u>Minimum</u>	<u>50%</u>	<u>80%²</u>	<u>90%</u>	<u>95%</u>	<u>Maximum</u>
Waihe`e-Hopoi	5589	4422	5583	5958	6126	6251	6305
`Iao-Waikapū	4993	3830	4990	5408	5597	5739	5836

¹See Table 10.

²80% probability is the industry standard for satisfying crop irrigation requirements. COL 74; FOF 457.

Source: Table 10; COL 66-93.

Table 12: HC&S's water deliveries, losses and over-Use, 2005-2006, in million gallons per day (mgd).

<u>Fields</u>	<u>Deliveries</u>	<u>Use</u>	<u>Requirements</u>	<u>Over-Use</u>	<u>Losses</u>
Waihe`e-Hopoi	35.58	22.87	19.96 ¹	2.91	12.71 (36% of deliveries)
ʻIao-Waikapū	10.43	10.26 ²			0.17 (2% of deliveries)
		7.67 ³	5.84 ⁴	1.83	
Total:	46.01	33.13⁵ (72%)			12.88 (28%)
		30.54⁶	25.80	4.74 (18% over requirements)	

¹3350 acres planted at the time, multiplied by 5958 gad (see table 11, 80% probability).

²When Field 920 is included, use averaged 7716 gad, or 10.26 mgd for 1330 acres. FOF 441

³When Field 920's 250 acres are excluded, use averaged 7098 gad, or 7.67 mgd for 1080 acres. FOF 443. Therefore, Field 920 used 2.59 mgd, or an average of 10,360 gad on its 250 acres during 2005-2006. It has been taken out of production.

⁴1080 acres, multiplied by 5408 gad (see table 11, 80% probability).

⁵Includes Field 920.

⁶Excludes Field 920.

Source: COL 235.

Table 13: Current and future uses, reasonable uses, practical alternatives, and net reasonable use, in million gallons per day (mgd).

	<u>Current/future uses</u>	<u>Reasonable uses</u>	<u>Practical alternatives</u>	<u>Net use</u>
Kuleana Lands/MCLT	3.71 ¹	3.71	2.0 ²	1.71
MDWS	3.2	3.2	none	3.2
WWC: uses	8.29 ³	2.37 ⁴	1.17 ⁵	3.20
losses	4.31	2.0	not applicable	
HC&S:				
Waihe'e-Hopoi Fields:				
uses	24.92 ⁶	21.75 ⁷	9.5 ⁸	14.25
losses	12	2	not applicable	
Iao-Waikapū Fields:				
uses	7.95 ⁹	6.06 ¹⁰	none	6.06
losses	0.17	⁸	not applicable	
<hr/>				
Total:	64.55	41.09	12.67	28.42

Source: COL 219-236.

¹Consumptive requirements of 1.71 mgd, plus 1.5-2.5 mgd (2 mgd average) for MCLT.

²Practical alternative for MCLT is the underlying basal aquifer.

³The maximum amount under WWC's Water Delivery Agreements. FOF 257.

⁴2.37 mgd in current use.

⁵Only 2.37 mgd were being used in 2006, of which 1.17 mgd had practical alternatives. The remaining 1.2 mgd had no practical alternatives.

⁶HC&S used an average of 6828 gad on 3350 acres in 2005-2006, but an additional 300 acres will have to be irrigated because of the closure of MLP, whose wastewaters previously irrigated these acres. Compare 24.92 mgd here for 3650 acres to the use of 22.87 mgd in Table 12, which was for 3350 acres.

⁷3650 acres x 5958 gad = 21.75 mgd.

⁸9.5 mgd from Well No. 7.

⁹HC&S used an average of 7098 gad on 1080 acres in 2005-2006 (table 12), or 7.67 mgd. An additional 40 acres has been placed into production, for a total of 1120 acres at a rate of 7098 gad, or 7.95 mgd.

¹⁰1120 acres x 5408 gad = 6.06 mgd.

¹¹Incorporated into the 2 mgd in reasonable losses for the Waihe'e-Hopoi Fields.

Table 14: Controlled flows proposed by USGS, in million gallons per day (mgd).

	<u>1st Phase</u>	<u>2nd Phase</u>	<u>3rd Phase</u>
Waihe`e ¹	10.0 (Q ₁₀₀ = 14)	17.0	30.0
North Waiehu ²	1.6 (= Q ₁₀₀)	2.2	2.9
South Waiehu ³	0.9 (Q ₁₀₀ = 1.5)	1.3	1.6
Wai`aloa ⁴	9.5 (Q ₁₀₀ = 7.1)	16.0	22.0
Waikapū ⁵	none	none	none
Total	22.0	36.5	56.5

¹ Just downstream of Spreckels Ditch.

² Below North Waiehu Ditch.

³ Below Spreckels Ditch.

⁴ Below Wai`aloa-Maniania Ditch.

⁵ No controlled releases.

Source: FOF 611-617.

Table 15: Average, median, and 90%-maximum requirements, in million gallons per day (mgd).

average requirements: ¹	37.92 mgd
median requirements : ²	36.10 mgd
90%-maximum ³ requirements: ³	38.74-39.66 mgd

¹uses the 80% probability as the average requirement for HC&S. See table 11. Thus, for the Waihe'e-Hopoi Fields, 3650 acres are multiplied by 5958 gad, and for the 'Iao-Waikapū Fields, 1120 acres are multiplied by 5408 gad, for a total of 21.75 mgd + 6.06 mgd = 27.81 mgd. Adding the 2 mgd in reasonable losses for HC&S and the net uses of 1.71 mgd for kuleana lands, 3.2 mgd for MDWS, and 3.20 for WWC, the total is 37.92 mgd.

²uses the median requirements for HC&S in table 11, and compares Q₅₀ flows to the three possible IIFS to estimate whether or not water available for offstream uses in these three scenarios would be sufficient to meet requirements. Because stream flows rise with rainfall and irrigation requirements drop with rainfall, the assumption is that the requirements would be at about the median level when flows are at Q₅₀ and that flows of Q₅₀ would be sufficient to meet the minimum to median requirements (4422 gad to 5589 gad for the Waihe'e-Hopoi Fields and 3830 gad to 4993 gad for the 'Iao-Waikapū Fields).

³compares requirements, Q₉₀ flows and the three possible IIFS to estimate whether water available for offstream uses would be sufficient to meet requirements. Assumes that requirements rise as stream flows decrease, because of the correlation with rainfall, and that when flows are at Q₉₀ levels, requirements would be at the 90% to maximum levels (6126 gad to 6305 gad for the Waihe'e-Hopoi Fields and 5597 gad to 5836 gad for the 'Iao-Waikapū Fields).

Table 16: Q₅₀ flows, proposed controlled releases, and water available for offstream uses with and without offsets for practical alternatives for HC&S, in millions of gallons per day (mgd).

Q ₅₀ flow	71.3	71.3	71.3
minus 1 st phase flow	12.5		
minus 2 nd phase flow		20.5	
minus 3 rd phase flow			49.3
<hr/>			
net flows available			
for offstream uses	58.8	50.8	22.0
<hr/>			
total requirements without practical alternatives for HC&S ¹			36.10
total requirements with practical alternative of 9.5 mgd for HC&S ²			26.60
<hr/>			

¹ median requirements of 5589 gad for 3650 acres for Waihe`e-Hopoi Fields, plus 4993 gad for 1120 acres for `Iao-Waikapū Fields (table 11), plus 1.71 mgd for kuleana lands, 3.2 mgd for MDWS, 3.20 mgd for WWC (2.0 mgd in losses and 1.20 in uses), and 2.0 mgd in losses for HC&S.

²from Well No. 7.

Table 17: Q₉₀ flows, proposed controlled releases, and water available for offstream uses with and without practical alternatives for HC&S, in million gallons per day (mgd).

Q ₉₀ flow	44.8	44.8	44.8
less 1 st phase flow	12.5		
less 2 nd phase flow		20.5	
less 3 rd phase flow			49.3
<hr/>			
net flows available			
for offstream use	32.3	24.3	0
<hr/>			
total requirements without practical alternatives for HC&S ¹			38.74-39.66
total requirements with practical alternative of 9.5 mgd for HC&S			29.24-30.16
<hr/>			

¹requirements range from 6126 gad at the 90% level to 6305 gad at the maximum level for Waihe'e-Hopoi Fields, and from 5597 gad at the 90% level to 5836 gad at the maximum level for 'Iao-Waikapū Fields. Table 11. See table 15, footnote 3, for how total requirements are calculated.

Table 18: Summary of current and future allowable diversions, in million gallons per day (mgd).

	<u>current/future requirements</u>	<u>practical alternatives</u>	<u>net requirements</u>
kuleana/MCLT	3.71	2.0	1.71
MDWS	3.2	none	3.2
WWC: uses	2.37	1.17	1.20
losses:	2.0	not applicable	2.0
HC&S:			
Waihe`e-Hopoi Fields:			
uses:	21.75	9.5 (part-time)	12.25 (up to 21.75)
losses:	2.0	not applicable	2.0
`Iao-Waikapū Fields:			
uses:	6.06	none	6.06
losses:	incorporated into the 2 mgd in reasonable losses for the Waihe-e-Hopoi Fields		
Total:	41.09	12.67 (9.5 mgd) part-time¹)	28.42 (37.92 mgd part-time¹)

¹When stream flows exceed the IIFS totals of 12.5 mgd, up to 37.92 mgd may be diverted. When less than 37.92 mgd is available, HC&S must use up to 9.5 mgd from Well No. 7 to make up the difference.

Table 19: Summary of amended IIFS for the Na Wai `Ehā Streams, in million gallons per day (mgd).

	<u>IIFS</u>	<u>estimated flow at mouth</u>
Waihe e River	10.0 (just downstream of Spreckels Ditch)	6.5
North Waiehu & South Waiehu Streams ²	1.6 (below North Waiehu Ditch) 0.9 (below Spreckels Ditch)	0.6
`Iao Stream	status quo	none
Waikapū Stream	status quo	none
Total	12.5	

STANDARD GROUND WATER USE PERMIT CONDITIONS

1. The water described in this water use permit may only be taken from the location described and used for the reasonable-beneficial use described at the location described above. Reasonable beneficial uses means “the use of water in such a quantity as is necessary for economic and efficient utilization which is both reasonable and consistent with State and County land use plans and the public interest.” (HRS § 174C-3)
2. The right to use ground water is a shared use right.
3. The water use must at all times meet the requirements set forth in HRS § 174C-49(a), which means that it:
 - a. Can be accommodated with the available water source;
 - b. Is a reasonable-beneficial use as defined in HRS § 174C-3;
 - c. Will not interfere with any existing legal use of water;
 - d. Is consistent with the public interest;
 - e. Is consistent with State and County general plans and land use designations;
 - f. Is consistent with County land use plans and policies; and
 - g. Will not interfere with the rights of the Department of Hawaiian Home Lands as provided in section 221 of the Hawaiian Homes Commission Act and HRS § 174C-101(a).
4. The ground water use here must not interfere with surface or other ground water rights or reservations.
5. The ground water use here must not interfere with interim or permanent instream flow standards. If it does, then:
 - a. A separate water use permit for surface water must be obtained in the case an area is also designated as a surface water management area;
 - b. The interim or permanent instream flow standard, as applicable, must be amended.
6. The water use authorized here is subject to the requirements of the Hawaiian Homes Commission Act, as amended, if applicable.
7. The water use permit application and submittal, as amended, approved by the Commission at its meeting are incorporated into this permit by reference.
8. Any modification of the permit terms, conditions, or uses may only be made with the express written consent of the Commission.
9. This permit may be modified by the Commission and the amount of water initially granted to the permittee may be reduced if the Commission determines it is necessary to:
 - a. protect the water sources (quantity or quality);
 - b. meet other legal obligations including other correlative rights;
 - c. insure adequate conservation measures;
 - d. require efficiency of water uses;
 - e. reserve water for future uses, provided that all legal existing uses of water as of June, 1987 shall be protected;
 - f. meet legal obligations to the Department of Hawaiian Home Lands, if applicable; or
 - g. carry out such other necessary and proper exercise of the State's and the Commission's police powers under law as may be required.

ATTACHMENT A

Prior to any reduction, the Commission shall give notice of its proposed action to the permittee and provide the permittee an opportunity to be heard.

10. An approved flowmeter(s) must be installed to measure monthly withdrawals and a monthly record of withdrawals, salinity, temperature, and pumping times must be kept and reported to the Commission on Water Resource Management on forms provided by the Commission on a monthly basis (attached).
11. This permit shall be subject to the Commission's periodic review for the applicable Aquifer System Area's sustainable yield. The amount of water authorized by this permit may be reduced by the Commission if the sustainable yield of the applicable Aquifer System Area, or relevant modified aquifer(s), is reduced.
12. A permit may be transferred, in whole or in part, from the permittee to another, if:
 - a. The conditions of use of the permit, including, but not limited to, place, quantity, and purpose of the use, remain the same; and
 - b. The Commission is informed of the transfer within ninety days.Failure to inform the department of the transfer invalidates the transfer and constitutes a ground for revocation of the permit. A transfer, which involves a change in any condition of the permit, including a change in use covered in HRS § 174C-57, is also invalid and constitutes a ground for revocation.
13. The use(s) authorized by law and by this permit do not constitute ownership rights.
14. The permittee shall request modification of the permit as necessary to comply with all applicable laws, rules, and ordinances that will affect the permittee's water use.
15. The permittee understands that under HRS § 174C-58(4), that partial or total nonuse, for reasons other than conservation, of the water allowed by this permit for a period of four (4) continuous years or more may result in a permanent revocation as to the amount of water not in use. The Commission and the permittee may enter into a written agreement that, for reasons satisfactory to the Commission, any period of nonuse may not apply towards the four-year period. Any period of nonuse which is caused by a declaration of water shortage pursuant to section HRS § 174C-62 shall not apply towards the four-year period of forfeiture.
16. The permittee shall prepare and submit a water shortage plan within 30 days of the issuance of this permit as required by HAR § 13-171-42(c). The permittee's water shortage plan shall identify what the permittee is willing to do should the Commission declare a water shortage in the applicable Ground Water Management Area.
17. The water use permit shall be subject to the Commission's establishment of instream standards and policies relating to the Stream Protection and Management (SPAM) program, as well as legislative mandates to protect stream resources.
18. The permittee understands that any willful violation of any of the above conditions or any provisions of HRS § 174C or HAR § 13-171 may result in the suspension or revocation of this permit.
19. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

The foregoing FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DECISION AND ORDER ARE HEREBY ADOPTED.

IT IS SO ORDERED.

DATED: HONOLULU, HAWAII, JUN 10 2010.

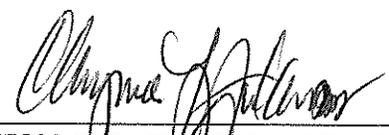
COMMISSION ON WATER RESOURCE MANAGEMENT
STATE OF HAWAII

By: 
LAURA H. THIELEN, Chairperson


WILLIAM D. BALFOUR, JR., Commissioner

SUMNER ERDMAN, Commissioner

NEAL S. FUJIWARA, Commissioner


CHIYOME L. FURINO, M.D., Commissioner


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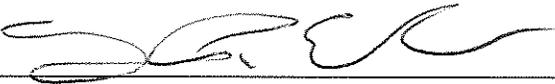
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1 COMMISSION ON WATER RESOURCE MANAGEMENT

2 STATE OF HAWAII

3 'Iao Ground Water Management Area) Case No. CCH-MA06-01
4 High-Level Source Water-Use)
5 Permit Applications and) DISSENTING OPINION OF THE
6 Petition to Amend Interim Instream) HEARINGS OFFICER/COMMISSIONER
7 Flow Standards of Waihe'e River) LAWRENCE H. MIIKE
8 And Waiehu, 'Iao, & Waikapū)
9 Streams Contested Case Hearing)

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19 DISSENTING OPINION OF THE
20 HEARINGS OFFICER/COMMISSIONER
21 LAWRENCE H. MIIKE

1 **Dissenting Opinion of Hearings Officer/Commissioner Lawrence Miike**

2 I dissent from the Commission’s majority on the amended IIFS.

3 In this Commission’s 1997 **Waiāhole Ditch Combined Contested Case: Findings of**
4 **Fact, Conclusions of Law and Decision and Order**, it set forth the following policy: “Where
5 scientific evidence is preliminary and not yet conclusive regarding the management of fresh
6 water resources which are part of the public trust, it is prudent to adopt ‘precautionary principles’
7 in protecting the resource. That is, where there are present or potential threats of serious damage,
8 lack of full scientific certainty should not be a basis for postponing effective measures to prevent
9 environmental degradation. ..In addition, where uncertainty exists, a trustee’s duty to protect the
10 resource mitigates in favor of choosing presumptions that also protect the resource.” Conclusions
11 of Law, p. 33.

12 Had this been only a statement of policy of the Commission members at that time, the
13 present Commission might have had the option to replace the policy with its own. However, that
14 option is no longer available. In its review of the Commission’s decision, the Hawai`i Supreme
15 Court concluded: “So defined, the precautionary principle simply restates the Commission’s
16 duties under the constitution and the Code. Indeed, the lack of full scientific certainty does not
17 extinguish the presumption in favor of public trust purposes or vitiate the Commission’s
18 affirmative duty to protect such purposes wherever feasible...Uncertainty regarding the exact
19 level of protection necessary justifies neither the least protection feasible nor the absence of
20 protection.” 94 Haw. 97, at 155.

21 Furthermore, when the **Waiāhole** Commission concluded that resource protection was “a
22 categorical imperative and the precondition to all subsequent considerations,” the Court’s
23 response was that “(g)iven the diverse and not necessarily complementary range of water uses,
24 even among public trust uses alone, we consider it neither feasible nor prudent to designate
25 absolute priorities between broad categories of use under the water resources trust.” 94 Haw. 97,
26 at 142. And as for private commercial uses, the Court stated that “the public trust has never been
27 understood to safeguard rights of exclusive use for private commercial gain,” 94 Haw. 97, at 138,
28 and that “insofar as the public trust, by nature and definition, establishes use consistent with trust
29 purposes as the norm or ‘default’ condition...it effectively prescribes a ‘higher level of scrutiny’
30 for private commercial uses...In practical terms, this means that the burden ultimately lies with

1 those seeking or approving such uses to justify them in light of the purposes protected by the
2 trust.” 94 Haw. 97, at 142.

3 The majority now turns all of these responsibilities on their heads. Where uncertainty
4 exists, they choose presumptions that protect offstream uses for private commercial purposes and
5 provide the least protection feasible or no protection at all to the waters of Nā Wai `Ehā. They
6 prescribe a higher level of scrutiny for resource restoration and not for private commercial uses.
7 And even when trust purposes themselves have no absolute priority, they give absolute priority
8 to one of the private commercial users in this contested case.

9 On offstream uses, my dissent from the majority is specifically on HC&S. We have no
10 disagreement on kuleana/MCLT, MDWS, and WWC, where we agree on current/future
11 requirements, practical alternatives, and net requirements. On HC&S’s irrigation requirements,
12 we have a moderate difference, 21.75 versus 20.71 mgd for the Waihe`e-Hopoi Fields, and 6.06
13 versus 5.77 mgd for the `Iao-Waikapū Fields, a total difference of 1.33 mgd, or about five
14 percent. But it is an example of the majority consistently choosing presumptions in favor of
15 HC&S and to the detriment of stream restoration. The most significant difference is the
16 assignment of 9.5 versus 18.54 mgd to HC&S’s Well No. 7 as a practical alternative. We both
17 agree that Well No. 7 should be used only during dry-weather conditions, when available stream
18 flows are insufficient to meet offstream requirements, but then the majority arbitrarily reduces
19 Well No. 7’s capacity in half.

20 On instream uses or stream restoration, the majority assigns whatever is left after taking
21 care of offstream uses, a total of 12.5 mgd, with 10.0 mgd to Waihe`e River and 1.6 mgd to the
22 North branch and 0.9 mgd to the South branch of Waiehu Stream. These are the lowest of three
23 proposed controlled flows by USGS.

24 These flows do not qualify as “restorations”: 1) 10 mgd for Waihe`e River is 4 mgd less
25 than its lowest recorded flow of 14 mgd, 2) the 1.6 mgd for North Waiehu is the lowest recorded
26 flow for that branch; and 3) 0.9 mgd is 0.6 mgd less than the lowest recorded flow of 1.5 mgd for
27 South Waiehu. Only the lowest of USGS’s proposed controlled flow for `Iao Stream of 9.5 mgd
28 is more than the lowest recorded flow of 7.1 mgd, but the majority refused to restore any water to
29 that stream. By reducing Well No. 7 as a practical alternative from approximately 19 mgd to 9.5
30 mgd, `Iao Stream’s restoration gave way to HC&S’s irrigation requirements, because only 9.5
31 mgd, and not 19 mgd, would be available from Well No. 7.

1 The following summarizes the process undertaken by the majority:

2 The irrigation model used by both Fares and HC&S are data-driven; i.e., its principal
3 elements are evapotranspiration rates and rainfall. HC&S provided a number of plausible reasons
4 why the results of the model are used only as a starting point, with actual amounts being applied
5 reflecting adjustments to actual day-to-day operations. COL 90. However, Fares's estimates
6 could be as much as 30 percent higher than what HC&S would have calculated. COL 89. I would
7 have used Fares' estimates as HC&S's irrigation requirements, with the 30% accounting for
8 adjustments to reasonable inefficiencies in day-to-day operations. But the majority chose to add
9 an additional 5% (compare tables 10 and 11). Thus, in the face of uncertainty over HC&S's
10 irrigation requirements, for which the lack of data was HC&S's own choosing, the majority
11 chose presumptions in favor of HC&S's offstream uses, to the detriment of protecting the
12 resource.

13 The majority chose not to restore any waters into `Iao Stream, on the rationale that the
14 downstream portions of the stream were so degraded that its reproductive potential was poor or
15 nonexistent. Yet they agree that the stream retained its potential for recruitment and growth of
16 healthy populations of stream animals from other streams, particularly if a bypass of the 20-foot
17 vertical drop was constructed and the diversions were revised to allow upstream migration.
18 However, even given the potential for healthy populations of stream life, the majority declined to
19 amend the IIFS for `Iao Stream nor to add the 9.5 mgd to Waihe`e River and North and South
20 Waiehu Streams. In both cases, the majority again chose presumptions to the detriment, and not
21 protection, of instream values. Moreover, restoration of the Na Wai `Ehā waters is of importance
22 for traditional and customary purposes. FOF 34-62, 233-234. In addition to its duty to resolve
23 uncertainty in favor of resource protection, the Commission has a duty to take feasible actions to
24 reasonably protect native Hawaiian rights. **Ka Pa`akai O Ka`aina v Land Use Commission**, 94
25 Haw. 31, at 47.

26 On Well No. 7 as a practical alternative for HC&S, two 17.5 mgd pumps can pump water
27 to the surface, from which 14 mgd can be pumped into the Waihe`e Ditch, and 800 acres of the
28 Waihe`e-Hopoi Fields could be directly irrigated (translating into 4.77 mgd if the majority's per
29 acre irrigation requirements were used, and 4.54 mgd if my estimates were used), or
30 approximately 19 mgd. FOF 494-497. I was in agreement that daily pumping at those levels
31 might not be sustainable, and therefore agreed that Well No. 7 should be used only when

1 available stream waters were insufficient to meet irrigation requirements. Moreover, as the
2 analysis of irrigation requirements and available stream waters shows (to be addressed later),
3 Well No. 7 would be used less than half of the time, and even under dry conditions, not all of its
4 designated capacity would be used. But the majority halved the practical amount from Well No.
5 7. The majority would not even entertain 19 mgd as the amount, with a decrease if that amount
6 could not be sustained. Again, the majority without any credible foundation chose 9.5 mgd as the
7 practical alternative from Well No. 7 to protect HC&S's interests, to the detriment of stream
8 resources.

9 The reduction of Well No. 7 as an alternative source from 19 to 9.5 mgd enabled the
10 majority of the Commission to balance this reduction against its refusal to amend the IIFS of `Iao
11 Stream to 9.5 mgd. If the majority had kept Well No. 7 at 19 mgd and still refused to add 9.5
12 mgd to `Iao Stream, they would have made available for offstream uses 9.5 mgd more than what
13 was reasonable-beneficial, without explanation as to why that amount should not be added to the
14 total IIFS.

15 I would have joined the majority had they not reduced the water available as a practical
16 alternative from Well No. 7 from 18.54 mgd to an arbitrary 9.5 mgd, and had kept the total IIFS
17 at 22 mgd instead of reducing it to 12.5 mgd. However, even that approach would likely not have
18 met the balancing test of the Code. In amending the interim instream flow standards, the
19 Commission "shall weigh the importance of the present or potential instream values with the
20 importance of the present or potential uses of water for noninstream purposes, including the
21 economic impact of restricting such uses." COL 4. The process of arriving at either 9.5 mgd or
22 my proposed 22 mgd as the total amended IIFS entailed no such weighing. The amended IIFS
23 were the amounts of water remaining after all offstream requirements were met; i.e., a residual—
24 not a balanced—approach. Such an approach does not rise even to the level of the "least
25 protection feasible."

26 A weighing between instream values and offstream purposes should begin with what
27 would be considered reasonable restoration efforts, followed by an assessment of their impacts
28 on offstream purposes, including the economic impact of restricting such offstream uses.

29 Reasonable restoration efforts might be to increase: 1) Waihe`e River's IIFS to 17.0 mgd,
30 or USGS's phase II flow; 2) North Waiehu Stream's IIFS to 2.9 mgd and South Waiehu

1 Stream's IIFS to 1.6 mgd, or USGS's phase III flow; and 3) `lao Stream's IIFS to 9.5 mgd, or
2 USGS's phase I flow. These amended flows would total 29.4 mgd.

3 In brief, the reasons for selecting these IIFS are as follows: For Waihe`e River, 17.0 mgd
4 would be 3 mgd over its lowest recorded flow of 14 mgd and provide a more reasonable base for
5 restoration of stream flora and fauna. Natural variations in stream flows below 17 mgd are built
6 into the IIFS, which only establishes the upper limit of the IIFS and recognizes that there will be
7 times when the actual stream flow will be less. For North and South Waiehu Streams, a modest
8 total increase of 2.0 mgd over the phase I flow would increase flows to phase III, a large gain for
9 a small increase. And for `lao Stream, 9.5 mgd was USGS's lowest recommendation, the
10 stream's phase I flow, yet still higher than the lowest recorded flow of 7.1 mgd.

11 If we substitute 29.4 mgd for 22 mgd in the amended IIFS, stream waters available for
12 offstream uses at median flows and requirements would decrease from my estimates of
13 reasonable/beneficial uses (based on Fares's estimates, instead of adding 5% more) of 49.3 mgd
14 to 41.9 mgd, still more than sufficient to meet the total requirements of 34.87 mgd even without
15 using Well No. 7.

16 If we perform the same analysis for when stream flows are low and requirements are high,
17 available stream waters would decrease from 22.8 to 15.4 mgd. Requirements even with full use
18 of 18.54 mgd from Well No. 7 would be 18.83-19.71 mgd, or a shortfall of 3.43 to 4.31 mgd.

19 Thus, with total stream restoration of 29.4 mgd, apportioned among Waihe`e River,
20 North and South Waiehu Streams, and `lao Streams as described above, the shortfall for
21 offstream uses would be about 4 mgd, and only for periods of low stream flows. During the 10%
22 of the time that total requirements would be about my estimate of 38 mgd, there would be a
23 shortfall of about 10.5%. For those periods between the Q_{90} and Q_{50} flows, there would be
24 periods ranging from a 10% shortfall to no shortfalls at all.

25 What would be the economic impact of this shortfall on offstream reasonable-beneficial
26 uses? Of the total average reasonable-beneficial uses of 36.59 mgd, 8.11 mgd are for kuleana
27 lands, MDWS, and WWC, and 28.48 mgd are for HC&S (using my estimate of HC&S's
28 reasonable/beneficial use). These apportionments equal 77.8% for HC&S, and 22.2% for all
29 other users.

30 At low stream flows, where total requirements are about 38 mgd, other users would still
31 require 8.11 mgd, or 21.3% of the total, and HC&S's requirements would increase to 29.89 mgd,

1 or 78.7% of the total. If we apportion shortfalls according to the percents used, at low stream
2 flows, where the total shortfall is estimated at 4 mgd, HC&S would be apportioned 3.15 mgd, or
3 10.5% of its requirements. If HC&S were made responsible for the entire shortfall of 4 mgd, then
4 it would be 13.4% short of requirements.

5 What would be the impact on HC&S's economic viability if it had to endure such
6 reductions in its irrigation requirements?

7 Approximately 5300 irrigated and unirrigated acres of HC&S's sugar plantation, or about
8 15 percent of the roughly 35,000 acres HC&S uses for sugar cane cultivation, are located in
9 HC&S's "West Maui Fields." FOF 417. Chan-Halbrendt, OHA's expert witness, concluded that
10 "the relevant issue requiring analysis is the economic impact of decreasing the supply, or
11 increasing the cost, of water to approximately 15 percent of HC&S's fields. Absent that analysis,
12 there is no reason to suppose that cessation of all sugar cultivation would be an economically
13 rational response." FOF 543.

14 HC&S stated that if reductions in its use of Nā Wai `Ehā stream water were of such a
15 magnitude as to force HC&S not to cultivate the 5300 acres that comprise the West Maui Fields,
16 HC&S would not be a viable operation. FOF 532. But rather than providing an analysis of the
17 magnitude of reductions that would lead to that result, HC&S instead outlined the consequences
18 if its entire 35,000 acre sugar operations were ended. FOF 532.

19 Even if HC&S had provided an economic analysis of the impact of closing down its West
20 Maui operations on its entire sugar operations and had concluded that such closure would mean
21 closing down its entire 35,000-acre enterprise, the Commission—including this Commissioner—
22 never contemplated such a scenario. The salient point was as identified by Chan-Halbrendt: "the
23 economic impact of decreasing the supply, or increasing the cost, of water to approximately 15
24 percent of HC&S's fields." Instead, HC&S chose to leap to its doomsday scenario—the drastic
25 consequences to Maui county and the state if it were to close its entire sugar operations.

26 Absent an economic analysis by HC&S, the Commission cannot assume that HC&S's
27 doomsday scenario would result from an occasional 10.5 to 13.4 percent decrease of its irrigation
28 requirements for 15 percent of its entire operations. Those decreases equate to only 1.6 to 2.0
29 percent of its irrigation requirements for its entire 35,000-acre operations, and then only on an
30 occasional basis. In the absence of any information supporting its doomsday scenario, the

1 Commission could not assume that HC&S's assertions overcame the presumption in favor of the
2 public trust resource, the streams of Nā Wai `Ehā.

3 Therefore, the Commission had good reasons to restore the streams by at least 29.4 mgd,
4 and it would have been HC&S's burden to petition the Commission to amend the IIFS again. By
5 giving HC&S more stream waters than required to operate its West Maui Fields, the
6 Commission's majority has forgotten that the purpose of this contested case was to restore Nā
7 Wai `Ehā's waters to reasonable levels that struck a balance between instream and offstream uses.
8 Instead, the Commission's majority took this as an opportunity to provide HC&S with all of its
9 water requirements—and I have argued that even more than that was granted—and treated the
10 IIFS not as stream restoration, but as leftovers, acting as a reservoir for future offstream uses.
11 The law's directive is clear: the object of the state water resources trust "is not maximum
12 consumptive use, but rather the most equitable, reasonable, and beneficial allocation of state
13 water resources, with full recognition that resource protection also constitutes use." COL 11.

14 This is my sixteenth year involved in state water resources issues, first as a
15 Commissioner in the original Waiāhole Contested Case, then as the hearings officer for the two
16 remands from the Hawai'i Supreme Court, and now again as a Commissioner and the hearings
17 officer in this contested case, where I was the only Commissioner to have heard and reviewed all
18 the evidence. I have specified two possible alternatives to the Commission's majority decision
19 to show that they could easily have reached a more balanced result. As the Supreme Court has
20 said: "Uncertainty regarding the exact level of protection necessary justifies neither the least
21 protection feasible nor the absence of protection." 94 Haw. 97, at 155. By its decision, the
22 majority has failed in its duties under the Constitution and the State Water Code as trustee of the
23 state's public water resources.

24
25 DATED: HONOLULU, HAWAII, JUN 10 2010.

26
27 COMMISSION ON WATER RESOURCE MANAGEMENT
28 STATE OF HAWAII

29
30
31
32 By:



LAWRENCE H. MIIKE, M.D., J.D., Commissioner
Hearings Officer

COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII

`Iao Ground Water Management Area) Case No. CCH-MA06-01
High-Level Source Water-Use)
Permit Applications and)
Petition to Amend Interim Instream)
Flow Standards of Waihe`e River)
and Waiehu, `Iao, & Waikapū)
Streams Contested Case Hearing)

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on this date a copy of the foregoing was served by U.S. mail, postage pre-paid or via State Messenger to the following parties addressed as follows:

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Dated: Honolulu, HI June 10, 2010.


KATHY YODA, Commission on Water Resource Management

COMMISSION ON WATER RESOURCE MANAGEMENT
STATE OF HAWAII

ʻIao Ground Water Management Area)	Case No. CCH-MA06-01
High-Level Source Water-Use)	
Permit Applications and)	ORDER CORRECTING CLERICAL
Petition to Amend Interim Instream)	ERROR IN FINDINGS OF FACT,
Flow Standards of Waihe`e River)	CONCLUSIONS OF LAW, AND
And Waiehu, ʻIao, & Waikapū)	DECISION AND ORDER
<u>Streams Contested Case Hearing)</u>	FILED JUNE 10, 2010

ORDER CORRECTING CLERICAL ERROR IN FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DECISION AND ORDER FILED JUNE 10, 2010

The Commission on Water Resource Management (CWRM) received a letter from Office of Hawaiian Affairs dated June 14, 2010. The letter brings to CWRM's attention an apparent clerical error in the Findings of Fact, Conclusions of Law, and Decision and Order (D&O) filed June 10, 2010.

At page 188, lines 24-26 of the D&O, CWRM ordered that "existing diversions on Waihee River and Waiehu streams that can be easily modified shall complete the necessary changes to implement the IIFS *in no less than two months.*" (Emphasis added). What CWRM meant was "in no more than two months."

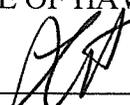
Accordingly, page 188, lines 24-26 of the D&O is hereby amended to state as follows: "Existing diversions on Waihee River and Waiehu streams that can be easily modified shall complete the necessary changes to implement the IIFS in no more than two months."

IT IS SO ORDERED.

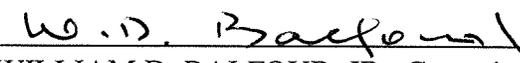
DATED: HONOLULU, HAWAII, JUN 23 2010

COMMISSION ON WATER RESOURCE MANAGEMENT
STATE OF HAWAII

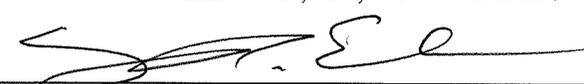
By:



LAURA H. THIELEN, Chairperson



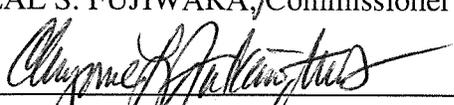
WILLIAM D. BALFOUR, JR., Commissioner



SUMNER ERDMAN, Commissioner



NEAL S. FUJIWARA, Commissioner



CHIYOME L. FUKINO, M.D., Commissioner



DONNA FAY K. KIYOSAKI, P.E., Commissioner

COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII

`Iao Ground Water Management Area)
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Case No. CCH-MA06-01

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KATHY YODA, Commission on Water Resource Management