STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
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STAFF SUBMITTAL

COMMISSION ON WATER RESOURCE MANAGEMENT

November 15, 2022
Honolulu, Hawai‘i

Address the Petition to Amend Instream Flow Standards (PAIFS.5784.6) by Amending the Interim Instream Flow Standards and Reserving a Portion of the Flow for the Department of Hawaiian Home Lands for the Huelo-Region Surface Water Hydrologic Units of Ho‘olawa (6035), Waipi‘o (6036), Hoalua (6038), Hanawana (6039), Kailua (6040), Nailiilihaele (6041), Puehu (6042), ‘O‘opuola (6043), Ka‘aiea (6044), Punalu‘u (6045), Kōlea (6046), East Maui

SUMMARY OF REQUEST

Staff is requesting that the Commission on Water Resource Management (Commission) consider the request for a surface water reservation of 2.054 cubic feet per second (cfs) (1.3275 million gallons per day, mgd) for the Department of Hawaiian Home Lands (DHHL) to meet a portion of their foreseeable future non-potable water needs serviced by the East Maui Irrigation System from streams in the Huelo region and address the Petition to Amend Instream Flow Standards (PAIFS) 5784.6 by amending the interim instream flow standard (interim IFS) for the following streams in the surface water hydrologic units of East Maui:

HO‘OLAWA (6035):	Hoolawaliilii Stream, Ho‘olawanui Stream, West Ho‘olawanui, Ho‘olawa Stream
WAIPI‘O (6036):	Waipi‘o Stream
HOALUA (6038):	Hoalua Stream
HANAWANA (6039):	Hānawana Stream
KAILUA (6040):	Kailua Stream, Oanui Stream
NAILIILIHAELE (6041):	Nailiilihaele Stream
PUEHU (6042):	Pa Stream
‘O‘OPUOLA (6043):	Makanali Stream, ‘O‘opuola Stream, ‘O‘opuola Tributary Stream, West ‘O‘opuola Stream
KA‘AIEA (6044):	Ka‘aiea Stream
PUNALU‘U (6045):	Punalu‘u Stream
KŌLEA (6046):	East Kōlea Tributary Stream, West Kōlea Tributary Stream

LOCATION MAP See Figure 1

LEGAL AUTHORITY

The State Water Code provides for reservations of water in both designated and non-designated water management areas. In designated areas, water reservations may be made pursuant to §174C-49(d), Hawaii Revised Statutes (HRS), which states:

> *The commission, by rule, may reserve water in such locations and quantities and for such seasons of the year as in its judgment may be necessary. Such reservations shall be subject to periodic review and revision in the light of changed conditions; provided that all presently existing legal uses of water shall be protected.*

Hawaii Administrative Rules (HAR) Subchapter 6 (Reservation of Water) includes §13-171-60 (Reservations of water) that provides further guidance for water reservations in water management areas:

> *(a) As provided in HRS §174C-49(d), the commission, by rule, may reserve water in such locations and quantities and for such seasons of the year as in its judgment may be necessary.*
>
> *(b) The commission shall adopt within this subchapter specific reservations of water in water management areas in such quantities as are deemed necessary for purposes which are consistent with the public interest, including the provision of water for current and foreseeable development and use of Hawaiian home lands pursuant to section 221 of the Hawaiian Homes Commission Act and HRS §174C-101(a).*
>
> *(c) Proceedings for the establishment of a reservation of water resources within a designated water management area by the commission may be initiated:*
> *(1) Upon recommendation by the chairperson; or*
> *(2) Upon written petition to the commission by any interested person with proper standing.*
>
> *(d) Reserved water shall not be allocated from water management areas by the commission except upon application for a water use permit by the party, or parties, for whom the water was reserved.*
>
> *(e) All reservations shall be subject to periodic review and revision in light of changed conditions.*

HRS §174C-101(a) also authorizes water reservations for DHHL, whether or not the area has been designated a water management area:

> *Decisions of the commission on water resource management relating to the planning for, regulation, management, and conservation of water resources in the State shall, to the extent applicable and consistent with other legal requirements and authority, incorporate*

> *and protect adequate reserves of water for current and foreseeable development and use of Hawaiian home lands as set forth in section 221 of the Hawaiian Homes Commission Act.*

In non-water management areas, the reservation of surface water for DHHL should be coordinated with the establishment of interim IFS.

The Code provides that the Commission may adopt interim IFS on a stream-by-stream basis or a general IFS applicable to all streams within a specified area. In the 2000 appellate ruling on the first Waiāhole Ditch Contested Case Hearing Decision and Order ("*Waiāhole I*"), the Hawaii Supreme Court emphasized that "instream flow standards serve as the primary mechanism by which the Commission is to discharge its duty to protect and promote the entire range of public trust purposes dependent upon instream flows." 94 Haw. 97, 148, 9 P.3d 409, 460. This submittal is proposing to address interim IFS on 19 streams in 11 surface water hydrologic units in East Maui.

The current interim IFS for the streams being considered were established by way of Hawaii Administrative Rules (HAR) §13-169-48, which, in pertinent part, reads as follows:

> Interim instream flow standard for East Maui. *The Interim Instream Flow Standard for all streams on East Maui, as adopted by the Commission on Water Resource Management on June 15, 1988, shall be that amount of water flowing in each stream on the effective date of this standard, and as that flow may naturally vary throughout the year and from year to year without further amounts of water being diverted off stream through new or expanded diversions, and under the stream conditions existing on the effective date of the standard.*

The current interim IFS effective date was October 8, 1988. Thus, the status quo interim IFS, in effect, grandfathered all then-existing diversions that were registered with the Commission by May 31, 1989. Following the initial registration of stream diversion works, any new or substantially modified stream diversion works required a permit for construction as well as an amendment to the interim IFS.

The Code defines an instream flow standard as a "quantity or flow of water or depth of water which is required to be present at a specific location in a stream system at certain specified times of the year to protect fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses." *See* HRS § 174C-3 ("Definitions").

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

1) Maintenance of fish and wildlife habitats;
2) Outdoor recreational activities;
3) Maintenance of ecosystems such as estuaries, wetlands, and stream vegetation;
4) Aesthetic values such as waterfalls and scenic waterways;
5) Navigation;

6) Instream hydropower generation;
7) Maintenance of water quality;
8) The conveyance of irrigation and domestic water supplies to downstream points of diversion; and
9) The protection of traditional and customary Hawaiian rights.

In considering a petition to amend an interim instream flow standard, the Code directs the Commission to "weigh the importance of the present or potential instream values with the importance of the present or potential uses of water for noninstream purposes, including the economic impact of restricting such uses." HRS § 174C-71(2)(D).

"Noninstream use" means the use of stream water that is diverted or removed from its stream channel and includes the use of stream water outside of the channel for domestic, agricultural, and industrial purposes.

Since the establishment of the Stream Protection and Management Branch in July 2002, the Commission has developed a framework for setting measurable instream flow standards statewide. This framework involves an assessment of natural flow conditions for the current climate period, an analysis of the instream uses protected by the State Water Code, the existing and planned uses of water, and the availability of water from multiple sources. The analysis for establishing interim IFS incorporates a balancing of the public trust uses with reasonable and beneficial uses. In some streams, reductions in downstream flow may affect the availability of surface water for other non-instream riparian uses, instream recreational uses, and aesthetic values. Reductions in streamflow have also limited the availability of habitat for native aquatic biota including amphidromous species and the protection of habitat for endemic damselflies, some of which are threatened or endangered. In *McBryde Sugar Co v. Robinson*, the Hawai'i Supreme Court identified riparian rights as "the right to use water flowing without prejudicing the riparian rights of others and the right to the natural flow of the stream without substantial diminution in the shape and size given it by nature". 54 Haw. at 198, 504 P.2d at 1344. 54 Haw. 174, 504 P.2d 1330. Further, the Hawai'i Supreme Court affirmed the unity of the hydrological cycle such that surface and groundwater represent an integrated source of water, and "where surface and groundwater can be demonstrated to be interrelated as parts of a single system, established surface water rights may be protected against diversions that injure those rights whether the diversion is of surface water or groundwater." *Reppun v. Board of Water Supply,* 65 Haw. at 531, 656 P.2d 57 at 79.

The public trust is a state constitutional doctrine which "continues to inform the Code's interpretation, define its permissible 'outer limits,' and justify its existence…(T)he Code does not supplant the protections of the public trust doctrine." *Waiāhole I*, 94 Hawai'i at 133, 9 P.3d at 445. The State Supreme Court has described "the public trust relating to water resources as the authority and duty 'to maintain the purity and flow of our waters for future generations and to assure that the waters of our land are put to reasonable and beneficial uses (*emphases in original)*." *Waiāhole I*, 94 Hawaii at 138, 9 P.3d at 450. "'Reasonable-beneficial use' means the use of water in such a quantity as is necessary for economic and efficient utilization, for a purpose, and in a manner which is both reasonable and consistent with the state and county land use plans and the public interest." HRS § 174C-3.

The Hawai‘i Constitution requires the Commission both to protect natural resources and to promote their use and development. “The state water resources trust thus embodies a dual mandate of 1) protection and 2) maximum reasonable and beneficial use.” *Waiāhole I*, 94 Hawai‘i at 139, 9 P.3d at 451. The purposes or protected uses of the water resources trust are: 1) maintenance of waters in their natural state, 2) domestic water use of the general public, in particular, protecting an adequate supply of drinking water, 3) the use of water in the exercise of Native Hawaiian traditional and customary rights, and 4) the reservation of water enumerated by the State Water Code. *Waiāhole I*, 94 Hawai‘i at 136-37, 9 P.3d at 448-58; *In re Wai‘ola o Moloka‘i, Inc.* (“*Wai‘ola*”), 103 Hawai‘i 401, 431, 83 P.3d 664, 694 (2004).

“In this jurisdiction, the water resources trust also encompasses a duty to promote the reasonable and beneficial use of water resources in order to maximize their social and economic benefits to the people of the state…(We) have indicated a preference for accommodating both instream and offstream uses where feasible..(and) reason and necessity dictate that the public trust may have to accommodate offstream diversions inconsistent with the mandate of protection, to the unavoidable impairment of public instream uses and values.” *Waiāhole I*, 94 Hawai‘i at 139, 141-42, 9 P.3d at 451, 453-54.

There are no absolute priorities under the Public Trust Doctrine. “Given the diverse and not necessarily complementary range of water uses, even among public trust uses alone, (the Court) consider(s) it neither feasible nor prudent to designate absolute priorities between broad categories of uses under the water resources trust. There are no absolute priorities between uses under the water resources trust…(and) the Commission inevitably must weigh competing public and private water uses on a case-by-case basis, according to any appropriate standards provided by law (emphasis added).” *Waiāhole I*, 94 Hawai‘i at 142, 9 P.3d at 454. The public trust creates an affirmative duty of the Commission “to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible[1] (emphasis added).” *Waiāhole I*, 94 Hawai‘i at 141, 9 P.3d at 453.

The water code does not place a burden of proof on any particular party; instead, the water code and case law interpreting the code have affirmed the Commission's duty to establish interim IFS that 'protect instream values to the extent practicable' and 'protect the public interest.'" *In re `Īao Ground Water Management Area High-Level Surface Water Use Permit Applications and Petition to Amend Interim Instream Flow Standards of Waihe`e River and Waiehu, `Īao, and Waikapu Streams Contested Case Hearing* ("*Nā Wai `Ehā*"), 128 Hawai‘i 228, 258, 287 P.3d 129, 159 (2012)), *citing In re Water Use Permit Applications* (“*Waiāhole II*”), 105 Hawai‘i 1, 11, 93 P.3d 643, 653 ((2004)); and HRS §174C-71((2))((A)). In setting an interim IFS, the Commission "need only reasonably estimate instream and offstream demands." *Nā Wai `Ehā*", 128 Hawai‘i at 258, 287 P.3d at 159 (2012)); "*Waiāhole I*", 94 Hawai‘i at 155 n. 60, 9 P.3d at 467 n. 60. "In requiring the Commission to establish instream flow standards at an early planning stage, the Code contemplates the designation of the standards based not only on scientifically proven facts, but also on future predictions, generalized assumptions, and policy judgments." *Waiāhole I*, 94 Hawai‘i at 155, 9 P.3d at 467.

[1] The Court refers to the term “feasible” as a balancing of benefits and costs and not to mean “capable of achievement.” (*Waiāhole I*, 94 Hawai‘i, at 141 n. 39; 9 P.3d, at 453 n. 39.)

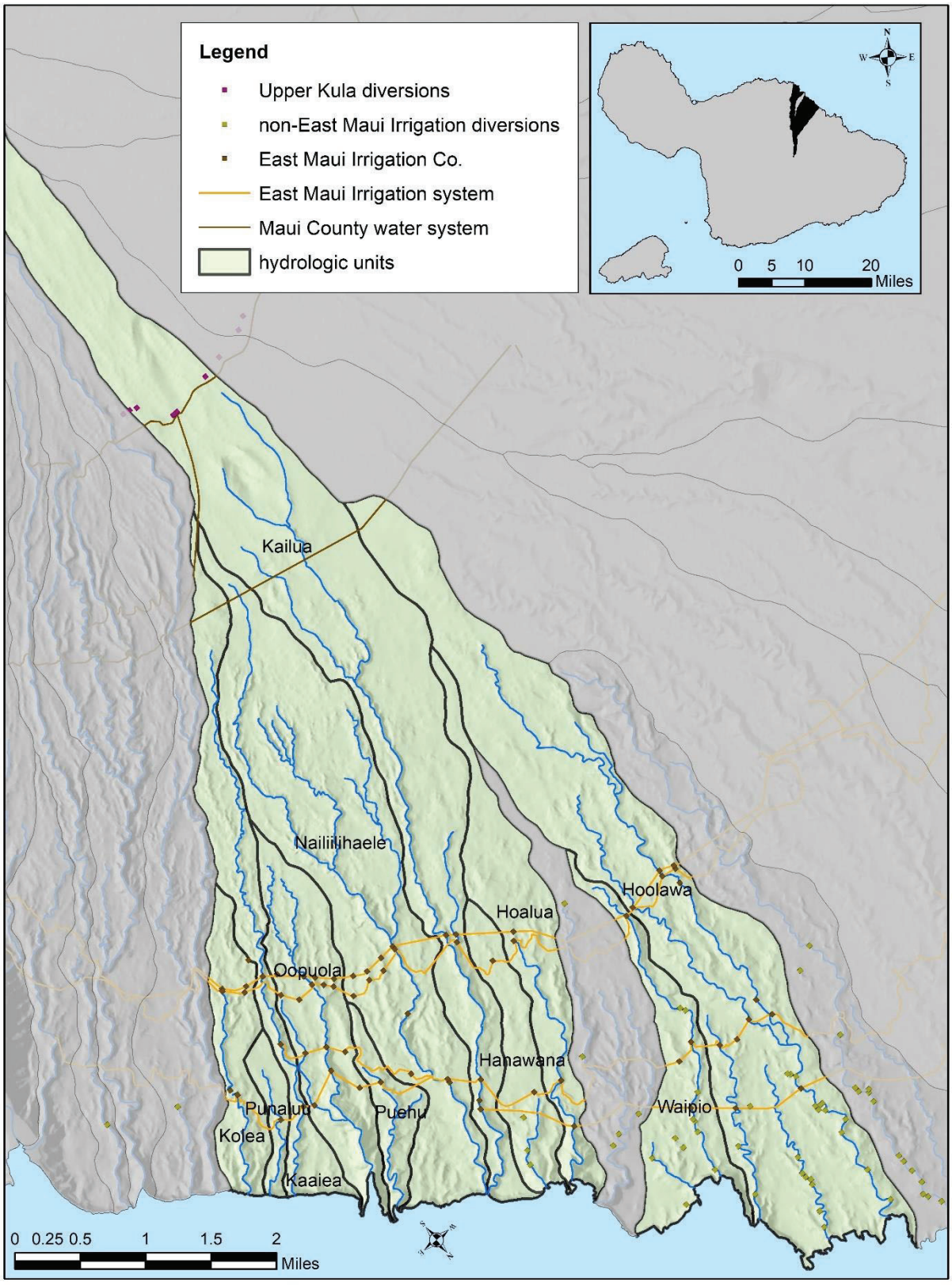
Further, Article 12, §7 of the Hawai‘i Constitution states that: “The State reaffirms and shall protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by ahupua‘a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the right of the State to regulate such rights.”

Where scientific evidence is preliminary and not yet conclusive regarding the management of fresh water resources, it is prudent to adopt the “precautionary principles” in protecting the resource[2]. That is, where there are present or potential threats of serious damage, lack of full scientific certainty should not be a basis for postponing effective measures to prevent environmental degradation…In addition, where uncertainty exists, a trustee’s duty to protect the resource mitigates in favor of choosing presumptions that also protect the resource.[3] The "precautionary principle" appears in diverse forms throughout the field of environmental law… The Hawai‘i Supreme Court confirmed that the principle, in its quintessential form, states: at minimum, the absence of firm scientific proof should not tie the Commission's hands in adopting reasonable measures designed to further the public interest. "*Waiāhole I*", 94 Hawai‘i at 155 n. 60 p.13.

Based upon the best available information presented in each of the Instream Flow Stream Assessment Reports (IFSAR) (Exhibit 8), along with the oral and written comments received through the public review process and provided in the informational briefing presented to the Commission at the regularly scheduled meetings on July 19, 2022, August 16, 2022, and September 18, 2022 (see Exhibits 3, 4, 6, 7, and 9), staff have developed a recommendation that seeks to balance public trust uses and the reasonable and beneficial needs of non-public trust uses. This process is challenging due to the unique nature of each stream, the various instream and noninstream uses of water, and the logistical challenges of instituting an interim IFS. Whether attempting to compare stream characteristics across multiple hydrologic units or within one unit, no single principal or equation determines the rate of flow restoration. However, the principals established by the State Constitution, the laws dictating the Hawai‘i State Water Code (HRS chapter 174C), and the statutes which are used to implement these laws (HRS) are applied equally.

[2] Commission on Water Resource Management. 1997. In the Matter of Water Use Permit Applications, Petitions for Interim Instream Flow Standard Amendments, and Petitions for Water Reservations for the Waiāhole Ditch Combined Contested Case Hearing. Final Decision & Order. CCH-OA-95-01.
[3] Ibid.

Figure 1. Hydrologic units in East Maui associated with the 2021 petitioned streams and their registered diversions, and water delivery systems.



The State Water Code (Code), Chapter 174C, Hawaii Revised Statutes (HRS), provides that the Commission shall have jurisdiction statewide to hear any dispute regarding water resource protection, water permits, or constitutionally or otherwise legally protected water interests. HRS §13-167-23. If any person files a complaint with the Commission that any other person is wasting or polluting water, or is making a diversion, withdrawal, impoundment, consumptive use of waters or any other activity occurring without a permit where one is required, the Commission shall cause an investigation to be made, take appropriate action, and notify the complainant thereof. HRS §13-167-82. Further, the Commission may take jurisdiction of and resolve any disputes regarding water resource protection, water permits, or constitutionally protected water interests. HRS §13-167-3(4).

Understanding that the availability of hydrologic data in these streams may be limited, as new data are developed, decisions may be revised by a future Commission action. Due to the complex and dynamic nature of Hawai‘i’s stream systems, adaptive management affords staff the ability to proceed in making reasonable management decisions and ensuring that impacts are minimized in the face of uncertainty, thus allowing staff to proceed responsibly while advancing the clear intentions of the Code.

EXISTING DHHL WATER RESERVATIONS

Thus far, the Commission has established a total of 29 potable and non-potable water reservations, all for DHHL, in both water management areas and non-designated water management areas.

Table 1 shows the previous water reservations made by administrative rule in water management areas, pursuant to HRS §174C-49(d) or by Commission action prior to the publication of the State Water Projects Plan 2017 Update.

Table 1. DHHL Water Reservations prior to the State Water Projects Plan 2017 Update.
[WMA = Water Management Area]

Approval Process	Island	Location	Effective Date	Reservation (mgd)
§13-171-61	O‘ahu	Waipahu-Waiawa WMA	02/18/1994	1.724
§13-171-62	O‘ahu	Waimānalo WMA	02/18/1994	0.124
§13-171-63	Moloka‘i	Kualapu‘u WMA	06/10/1995	2.905*
CWRM Action	Hawai‘i	Keauhou Aquifer	08/17/2015	3.398

* Per HAR §13-171-63, this amount shall be in excess of the existing uses of water on Hawaiian home lands as of the effective date of this rule (Eff. June 10, 1995)

STATE WATER PROJECTS PLAN 2017 UPDATE

More recently, reservation actions were supported by preliminary findings in the most recent update of the State Water Projects Plan, which was formally adopted by the Commission on May 16, 2017. The State Water Projects Plan is the component of the Hawai‘i Water Plan that documents the water needs of all State agencies over a 20-year planning horizon. The

Engineering Division of the Department of Land and Natural Resources is responsible for the development and update of the State Water Projects Plan. In addition to inventorying the existing and future water needs for State projects, through the State Water Projects Plan, Engineering Division also promotes partnerships and cost sharing to coordinate water development projects and water infrastructure improvements of potentially competing State agencies. Based on the State Water Projects Plan, Engineering Division pursues legislative funding to support new source development through Capital Improvement Project requests and administers a water credit allocation program for State agencies. Implementation of the State Water Projects Plan in close coordination with the County Water Use and Development Plan is needed to ensure orderly authorization and development of new State sources and water system infrastructure.

Initially adopted in 1990 and revised in 2003, a third update of the State Water Projects Plan was completed and adopted in 2017[4]. Due to funding constraints, the Engineering Division focused this most recent State Water Projects Plan update exclusively on DHHL. DHHL was selected because: 1) they are the largest landowner amongst State agencies and thus could have the most significant impact on water resource development and use, and 2) DHHL water needs are an identified public trust purpose under the State Constitution and Water Code.

The Engineering Division and its consultant worked extensively with DHHL staff to identify priority tracts and proposed phasing over the 20-year planning horizon and to determine the breakdown of each tract in terms of residential units and agricultural acreages. The 20-year timeframe is established under HAR §13-170-42(c), which requires the State Water Projects Plan to consider a 20-year projection period for analysis purposes.

Potable water requirements were calculated by correlating DHHL's land use designations to an equivalent zoning designation in the County Water System Standards (or other applicable standards when necessary) and applying the respective unit rate (Exhibit 1). All demands from the domestic component of homesteading (Residential, Subsistence Agriculture, Pastoral) and municipal (Community Use, Commercial, Industrial) land use designations were considered to be potable.

Non-potable requirements were considered to be irrigation demands for agricultural land use designations (Subsistence, Supplemental, and General Agriculture) and stock water (sustenance water for livestock) for the Pastoral land use designation. Agricultural non-potable demands were calculated using a unit rate of 3,400 gallons per acre per day, as recommended by the Department of Agriculture's Agricultural Water Use and Development Plan. Based on published studies, a livestock watering unit rate of 20 gallons per head per day was used for Pastoral land use designations. The unit rate non-potable requirements are shown in Exhibit 1.

[4] Engineering Division also received separate funding to update the State Water Projects Plan for the North Kona region on the island of Hawai'i, as well as for a comprehensive statewide update. The statewide update will incorporate the 2017 update (which documents DHHL water needs) as well as the regional update for North Kona in order to develop comprehensive and coordinated water development strategies that consider and coordinate the needs and plans of all State agencies.

A range of forecasts - high, medium, and low – were developed for both potable and non-potable end use water demands. Variability was achieved by adjusting project development data while keeping water demand unit rates fixed. Examples of adjustments included varying unit buildout rates, utilizing different unit density rates, and using different percentages of utilization of the total area for development. However, while the range of water demands for the various end uses were assessed, only the medium demand projections by water source (e.g., aquifer system areas to be developed) were provided.

The 2017 update of the State Water Projects Plan provides a sound basis and rationale for water reservations statewide for DHHL for both potable needs (groundwater) and non-potable needs (surface water) by hydrologic unit. After discussions with DHHL staff, it was decided that the establishment of additional water reservations begin with potable groundwater needs in non-designated areas on the islands of Kaua‘i, Maui, Lana‘i, and Hawai‘i for the following reasons:

- DHHL’s needs within designated ground water management areas on the island of O‘ahu are most likely to be met through the Honolulu Board of Water Supply’s (HBWS) integrated municipal water system. As shown in Table 1, DHHL has existing reservations from the Waipahu-Waiawa and Waimanalo Aquifer System Areas on O‘ahu. As DHHL tracts are developed, these reservations are to be converted to water use permits and transferred to the HBWS for water service. DHHL has no current plans to pursue new source development and does not plan to operate new water systems on O‘ahu. According to DHHL, DHHL is already in discussions with HBWS to service DHHL tracts on O‘ahu and has received verbal commitment from HBWS. HBWS is in the process of updating its Water Use and Development Plan, and the regional watershed management plans for the Primary Urban Center, ‘Ewa District, and Central O‘ahu are currently underway and should incorporate DHHL needs and strategies based on the 2017 State Water Projects Plan.

- DHHL’s needs within non-designated aquifer system areas on the island of O‘ahu (Wai‘anae Sector Area) will also be met through the Honolulu Board of Water Supply’s (HBWS) integrated municipal water system. DHHL will rely on HBWS for new source development in the Wai‘anae Sector Area. DHHL is already in discussions with HBWS to service DHHL tracts on O‘ahu and has received verbal commitment from HBWS.

- Besides O‘ahu, the only other areas that are currently designated as a groundwater management area is the island of Moloka‘i, and the ‘Īao Aquifer System on Maui. As shown in Table 1, there is an existing water reservation for DHHL for the Kualapu‘u Ground Water Management Area for 2.905 mgd in addition to existing uses; however, the 2017 State Water Projects Plan shows a projected need for only 0.840 mgd until 2031.

- Staff’s preliminary review of non-potable surface water needs in the 2017 State Water Projects Plan indicate that in some cases, where there are available streamflow records, proposed future needs exceed the available flow in the stream. In most cases, however, there is no available streamflow data to compare with the proposed water needs.

- Additionally, current information on other existing off-stream uses is lacking. **Therefore, reservations for surface waters should be done in concert with staff's establishment of instream flow standards (emphasis added),** which will involve the collection of the data and information necessary to vet the amounts to be reserved.

On June 20, 2017, the Commission approved a reservation of 6.903 mgd of non-potable water from the Waimea Surface Water Hydrologic Unit, on the island of Kaua'i, for DHHL's 15,061 acres of land mauka of the mana plain, which were historically fed by the Kōke'e Ditch with water diverted from Kōke'e, Kauaikinanā, Kawaikōī, and Waiakoali streams during the operation of the Kekaha Sugar Company. This reservation was filed on April 25, 2017 following the April 18, 2017 Commission-approved Waimea Watershed Agreement Mediated Settlement. This reservation supersedes DHHL's previous petition for 33.145 mgd filed with the Commission on November 17, 2015.

On October 16, 2018, the Commission approved a reservation of 0.513 mgd of non-potable water from the Wailua Surface Water Hydrologic Unit, on the island of Kaua'i, for non-potable water needs of DHHL's lands East of Kālepa Ridge.

On March 27, 2020, the Commission approved a reservation of 1.600 mgd non-potable water from four tributaries of the Wailuku River (i.e., 'Āwehi, Aale, Laualu, Kapehu).

On May 18, 2021, the Commission approved a reservation of 2.00 mgd non-potable water from the Honokōhau Stream for agricultural use in the Honokōwai tract in West Maui.

Table 2 shows all water reservations established via Commission action in non-designated water management areas, pursuant to HRS §174C-101(a).

On June 12, 2019, DHHL submitted their final environmental impact statement for the Pūlehunui Regional Infrastructure Master Plan (Pūlehunui Master Plan) on Maui. Staff from DHHL and CWRM began discussing the availability of non-potable water no meet non-potable demands in this development. On December 16, 2020, DHHL submitted their formal reservation for non-potable water for future DHHL land uses in Pūlehunui and Kēōkea-Waiouli. The revised acreage, use, and water duties for this reservation are provided in Table 3. Based on these data, DHHL determined their non-potable reservation to be 11.1775 mgd. The breakdown for this reservation is provided in Table 3.

Table 2. DHHL Water Reservations in Non-Designated Water Management Areas

Island	Hydrologic Unit	type	Action Date	Initial Reservation (mgd)	Current Reservation (mgd)
Kauaʻi	Waimea*	non-potable	06/20/2017	6.903	6.903
	Wailua	potable	09/18/2018	0.708	0.708
	Wailua*	non-potable	10/16/2018	0.513	0.513
	Anahola	potable	09/18/2018	1.470	1.470
	Kekaha	potable	09/18/2018	0.336	0.336
	Makaweli	potable	09/18/2018	0.405	0.405
Lanaʻi	Leeward	potable	09/18/2018	0.067	0.067
Maui	Honokōhau*	non-potable	05/18/2021	2.000	2.000
	Honokōwai	potable	09/18/2018	0.770	0.770
	Kamaʻole	potable	09/18/2018	2.547	2.547
	Keʻanae	potable	09/18/2018	0.003	0.003
	Kawaipapa	potable	09/18/2018	0.118	0.118
	Lualaʻiula	potable	09/18/2018	0.063	0.063
Hawaiʻi	Wailuku*	non-potable	03/17/2020	1.600	1.600
	Keauhou	potable	08/17/2015	3.398	3.398
	Hawi	potable	09/18/2018	0.148	0.148
	Māhukona	potable	09/18/2018	3.014	3.014
	Honokaʻa	potable	09/18/2018	0.396	0.396
	Hakalau	potable	09/18/2018	0.083	0.083
	Onomea	potable	09/18/2018	0.250	0.250
	Hilo	potable	09/18/2018	0.492	0.492
	Keaʻau	potable	09/18/2018	1.336	1.336
	ʻŌlaʻa	potable	09/18/2018	0.025	0.025
	Nāʻālehu	potable	09/18/2018	0.185	0.185
	Pāhoa	potable	09/18/2018	0.660	0.660

* Surface Water Hydrologic Unit

CONSISTENCY WITH THE HAWAII WATER PLAN

The Hawaiʻi Water Plan is the State's long-range water plan, and staff believes it is important that water reservations be consistent with, and have basis in, the Hawaiʻi Water Plan (HWP). Under the current planning framework, the State Water Projects Plan outlines the water needs for State projects (in this case for DHHL), identifies potential supply options, and feeds into the County Water Use and Development Plans. This enables State water needs to be integrated with the needs of all other use sectors (i.e., military, municipal, private, and agriculture) within each county into a comprehensive resource development strategy and implementation plan. However, county updates to their Water Use and Development Plan are often not as frequent, comprehensive, or timely to provide for such reservations as needed. As previously described, the 2017 Update to the State Water Projects Plan identifies the non-potable water needs of DHHL.

Should water reservations be approved, staff will inform the counties so that the reservations will be incorporated into the County Water Use and Development Plans as required by law. Reserving water for DHHL promotes the Commission's approach to managing the resource and protecting the public trust through the collaboration and consistency framework provided by the HWP.

Table 3. Acreage, water demand rate (gallons per acre per day, gpad) and total water demand (gallons per day) by land use for the DHHL water reservation, with non-potable totals.

Land Use	Type	Area (acre)	Rate (gpad)	Water Demand (gpd)
Pūlehunui				
Subsistence Agriculture	non-potable	269	2,500	672,500
Supplemental Agriculture	non-potable	28	2,500	70,000
General Agriculture	non-potable	154	2,500	385,000
Industrial	potable	31	--	--
Community Use	non-potable	80	2,500	200,000
Commercial		84	--	--
	Total =	646		1,327,500
Kēōkea & Waiohuli				
Residential	potable	1,160	--	--
Subsistence Agriculture	potable	170	--	--
Community Use	potable	69	--	--
Conservation	potable	773	--	--
General Agriculture	non-potable	3,940	2,500	9,850,000
	Total =		Total =	11,117,500

BRIEF OVERVIEW

In 2001, a petition to amend the interim IFS was filed by Maui Tomorrow and the Native Hawaiian Legal Corporation for 27 streams in East Maui (2001 Petition), of which 22 were affected by the water delivery system managed by the East Maui Irrigation (EMI) Co. Following hydrological[5] and ecological[6] studies conducted by the U.S. Geological Survey, fieldwork by the State of Hawai'i Division of Aquatic Resources and Commission on Water Resource Management, and numerous public outreach meetings, interim IFS were recommended by staff in 2008 and approved by the Commission addressing streamflow where instream uses included the cultivation of wetland kalo. Then in 2010, interim IFS were recommended by staff and approved by the Commission addressing streamflow in streams whose instream uses included habitat for freshwater biota, aesthetic values, and recreational values. This decision was contested by the petitioners, and the East Maui Contested Case Hearing (East Maui CCH) proceeded from 2011 to 2017.

[5] Gingerich, S.B. 2005. Median and low-flow characteristics for streams under natural and diverted conditions, Northeast Maui, Hawaii. Scientific Investigations Report 2004-5262.

[6] Gingerich, S.B., Wolff, R.H. 2005. Effects of surface-water diversions on habitat availability for native macrofauna, Northeast Maui, Hawaii. U.S. Geological Survey Scientific Investigations Report 2005-5213.

Following the conclusion of the East Maui CCH, the Commission issued a final Decision & Order[7] (2018 Decision & Order), which evaluated the best available information presented in the East Maui CCH regarding the availability of water, the instream uses of water, and the non-instream uses of water, and ordered the full restoration of streams which supported extensive cultivation of wetland kalo or community usage. These streams were identified as Honopou, Hanehoi, Palauhulu, Waiokamilo, Wailuanui, and Makapipi. Some of these streams also supported high levels of low elevation (e.g., estuarine) and higher elevation habitat for freshwater biota. In regions where streams were considered "gaining", such that groundwater contributed to increased flow downstream of the water delivery systems, the Commission considered these sources as opportunities to utilize water to meet non-instream uses.

As part of the 2018 Decision & Order, the Commission evaluated the availability of water from all sources, including the other streams and groundwater resources not part of the 2001 petition. This includes streams diverted by the EMI system outside of the petition as well as streams diverted by Maui County's Upper Kula and Lower Kula water systems. The Commission estimated the quantity of water which was available in each stream and the quantity of water which would be available for off-stream use for a given interim IFS. The 2018 Decision & Order had a goal of being realistically implemented, measurable, understood by stakeholders, and to reasonably accommodate non-instream uses under the current conditions, such that on-going monitoring can be used to adapt to changing circumstances. These basic tenets will also be used to support recommended modifications to instream flow standards in future decisions.

In September 2021, the Sierra Club filed a petition (2021 Petition[8]) to amend the interim IFS for the streams in the eleven hydrologic units (PAIFS.5784.6) of the Huelo Region (other than Hanehoi and Honopou hydrologic units). The interim IFS for these hydrologic units will be addressed in this staff submittal.

ISSUES/ANALYSIS

This section of the submittal begins with general considerations of issues that broadly apply to the development of an IFS. A discussion then follows of the unique hydrogeologic environment, the instream uses, and the noninstream uses of water. The general considerations are followed by an assessment summary for each stream and a simplified schematic diagram. The summary and diagram identify key points from the IFSAR while summarizing the hydrologic characteristics and is by no means intended to substitute for the information compiled in the report.

The next step to developing an interim IFS is to balance often-competing instream and noninstream uses of water, which may include public trust uses, against the amount of water available to accommodate the needs of these uses. Again, the quantity and quality of information varies from stream to stream. This step is further complicated by the tremendous variability of instream and non-instream uses across and within surface water hydrologic units. For example, one stream may support extensive *kalo* cultivation while another may primarily

[7] https://files.hawaii.gov/dlnr/cwrm/cch/cchma1301/CCHMA1301-20180620-CWRM.pdf
[8] https://files.hawaii.gov/dlnr/cwrm/activity/eastmaui3/20210928-PAIFS.pdf

support domestic uses. The potential of the stream and hydrologic unit to support additional water use in the future has also been considered. The four public trust uses of water include: (1) Water in its natural state; (2) Water used for traditional and customary practices; (3) Water for domestic uses; and (4) Water reserved and used by the Department of Hawaiian Home Lands. The process is to be based upon best available information when balancing the present or potential, instream and non-instream uses.

In developing the interim IFS recommendations, staff has attempted to remain consistent in balancing all of the instream and noninstream uses of each stream based upon the best available information presented in the IFSAR, and follow up fieldwork and data analysis, along with the oral and written comments received through the public review process. This process is challenging due to the unique nature of each stream, the various instream and noninstream uses of water, and the logistical challenges of instituting an interim IFS. Whether attempting to compare stream characteristics across multiple hydrologic units or within one unit, no single principal or equation determines the rate of flow restoration. However, the principals established by the State Constitution, the Hawai‘i State Water Code (HRS 174C), administrative rules, and case law interpreting all of the above, are applied appropriately.

Hydrogeologic Context

The first step in developing an interim IFS is assessing the hydrogeology of the hydrologic unit. Freshwater resources originate as precipitation, falling in the form of rain, but also through fog drip intercepted by vegetation. Some of the precipitation evaporates from the canopy or the soil, some is transpired by plants, some flows as overland flow in runoff contributing to surface flow, and some infiltrates the soil and contributes to groundwater recharge. Much groundwater is stored in the basal aquifer found in the dike-free lava flows of the shield building phase of the volcano. This basal aquifer lens sits on the brackish transition zone, which then overlies saltwater. “High-level” groundwater occurs where water is impounded by dikes or perched on buried low-permeability horizons. Where the stream channel has incised into high-elevation groundwater, streams gain base flow (USGS SIR 2015-5164; p.100). In East Maui, the surface geology is characterized by Kula volcanics, which are mainly aa flows (lava characterized by jagged, sharp surfaces with massive, relatively dense interior) poured out at progressively longer intervals so that numerous valleys were cut between the younger lava flows. The older flows are massive, aggregating 2,000 feet thick on the summit and thin toward the isthmus where they are only about 50 feet thick. In the eastern end of Haleakalā near Nāhiku, perched high-level groundwater is held up by the relatively low permeability Kula volcanics and associated weathered soils and ash beds (Gingerich, 1999a). Elsewhere they contain fresh water at sea level, but it is brackish along the leeward shore. Areas near the heads of the hydrologic units include geologic formations (weathered cinders, spatter, and pumice) originally built along fissures by fire fountains (sprays of gases carrying magma from vents, spewing up to several hundred feet high, producing “spatter”) at the source of the lava flows, forming a few perched spring water systems. The Honomanū volcanic series, which predates the Kula volcanics, forms the basement of the entire Haleakalā mountain to an unknown depth below sea level. They are predominantly pahoehoe flows (lava characterized by a smooth or ropy surface with variable

interior, including lava tubes and other voids), ranging from 10 to 75 feet thick and are very vesicular. The Honomanū basalts are extremely permeable and yield water freely[9].

Hydrologic Considerations

Streams are largely characterized by different hydrologic and geologic components that affect flow regimes, particularly the groundwater-surface water interactions and rainfall-driven runoff. The amount of water flowing in a given stream is also affected by regional climate variations (e.g., rainfall, fog drip, solar radiation). The quantity and quality of data available to characterize these geologic and hydrologic components also varies considerably from stream to stream. For streams with long-term continuous data, the process for developing an interim IFS may be greatly different from that for streams with limited hydrologic data. For example, the groundwater contributions to surface flow (i.e., base flow) can be determined using continuously recorded data and statistical analyses, while record-augmentation is used with partial-record gaging stations to estimate low-flow characteristics where no continuous data exist.

Groundwater-surface water interactions influence the extent of gaining and losing stream reaches. A gaining reach is where the streambed intersects the underlying water table and groundwater contributes to streamflow as seepage or springs. A losing reach is where the streambed is above the water table and surface water infiltrates into the streambed and recharges the aquifer, sometimes leaving the stream dry even in undiverted conditions.

A common misconception is that flow restoration from diversions is immediately followed by continuous flow downstream from the point of release all the way to the coast (analogous to turning on a faucet); however, this is not always the case. For a stream that is losing, restored flow infiltrates underground once it reaches the losing section, and flow is often absent downstream of the losing reach. In some cases, flow will become continuous only after enough water has infiltrated the streambed and raised the water table, allowing base flow to be maintained by equilibrium with sub-surface flow. In other cases, the restored stream will remain dry at low-flows where the water table drops below the elevation of the stream bed. A stream can also become dry from prolonged periods of little or no rainfall as the water table drops below the streambed. In this case, adequate rainfall is necessary to restore the interaction between surface and groundwater, and to return base flow in the stream.

Most reaches in the hydrologic units of East Maui are gaining reaches, although streams that incise Honomanū and Hana volcanics are typically losing reaches due to the high permeability of these geologic layers. For example, low elevation reaches in the Honomanū and ʻOʻopuola streams in East Maui are losing flow near the stream mouth.

Historic U.S. Geological Survey data and newly gathered data regarding low-flow characteristics in streams in the Huelo area were summarized in Strauch (2022[10]).

[9] Stearns, H.T., MacDonald, G.A. 1942. Geology and Ground-water Resources of the Island of Maui, Hawaii. Bulletin of Hydrography, 7. U.S. Geological Survey. Honolulu, HI.
[10] https://files.hawaii.gov/dlnr/cwrm/publishedreports/PR202201.pdf

Trends in Rainfall and Streamflow

Long-term (1920-2012) and recent (1983-2012) trends indicate significant declines in rainfall across areas of East Maui, particularly during the dry season (Frazier and Giambelluca, 2017[11]). Long-term declines in rainfall are generally coupled with a long-term decline in surface water availability and groundwater recharge, with consequences for base flow (Bassiouni and Oki, 2013[12]).

Since this decision, Commission staff have work closely with the Division of Aquatic Resources (DAR) to gather additional hydrological and ecological data. These efforts include a comprehensive survey of stream mouths in East Maui, temporal and spatial biota surveys in East Maui, and additional hydrological data collection. These data are being used to inform follow up recommendations.

To provide context for the recommendations outlined in this submittal specific to those streams in the 2021 petition, data from all streams in East Maui affected by these water delivery systems are detailed. This includes topographic and geographic features of each primary stream in each hydrologic unit (Table 4), hydrologic features (Table 5), and biological features (Tables 6 and 7).

Specifically, the distribution of habitat available for aquatic biota in all streams in the East Maui following the 2018 Decision & Order relative to the availability under natural conditions broken down by streams identified in the 2001 petition and streams identified in the 2021 petition.

Summary of 2020-2022 Biota Surveys

From 2020 to 2022, Commission staff and staff from the Division of Aquatic Resources conducted stream biota and habitat surveys at 56 locations, with 38 locations in the East Maui region. Stream surveys spanned a variety of reach types, from low-elevation (<100 ft), low gradient (<4%) reaches near stream mouths, to high elevation (>1200 ft), high gradient (>10%) reaches, and reach locations spanning the 400-800 ft mid-elevation range. Sites were selected based on accessibility, diversity of elevations, streamflow, and terminal reach condition (e.g., estuary or waterfall). Surveys in East Maui at low and mid-elevation reaches were conducted with the lower elevation irrigation systems inactive for the proceeding four years, providing continual flow and connectivity between stream mouth and study reach. The goal of the study was to test the hypothesis that terminal reach condition affected upstream recruitment of specific amphidromous species to middle- and high-elevation reaches. Previous work has examined the behavioral and morphological traits of amphidromous fishes in Hawai‘i to make generalizations about habitat preferences (Figure 3). However, no large-scale, comprehensive survey of stream biota has been conducted to test if stream mouth affects community structure. The density (e.g., normalized abundance) and size of native and non-native species were quantified using visual

[11] Frazier, A.G., Giambelluca, T.W. (2017). Spatial trend analysis of Hawaiian rainfall from 1920 to 2012. *International Journal of Climatology*, 37(5): 2522-2531.
[12] Bassiouni, M., Oki, D.W. (2013). Trends and shifts in streamflow in Hawai‘i, 1913-2008. *Hydrological Processes*, 27: 1484-1500.

point-quadrat surveys (20x per reach) along with the collection of stream channel and habitat characteristics.

Streams with estuaries at their mouths supported a greater number of species and at higher densities compared to streams with terminal waterfalls (Figure 4). As expected, amphidromous species abundance varied by elevation and each species' climbing abilities, with better climbers inhabiting higher elevation reaches. The exception to this was in stream mouths of terminal reach waterfalls, where, likely due to a lack of competition, ʻoʻopu alamoʻo which could be found near the mouth (Figure 4). We observed a difference in ʻoʻopu nākea (*Awaous stamineous*) abundance among reach elevations, with more fish occupying lower-elevation habitats than mid- and high-elevation in streams without terminal waterfalls. We also observed greater densities of ʻoʻopu nōpili (*Sicyopterus stimpsoni*) in mid-elevation reaches in streams without terminal waterfalls. These conclusions support previous work identifying the distribution of species likely to inhabit stream reaches of various characteristics[13].

The available habitat that can be colonized by recruiting amphidromous species in East Maui varies with stream size, which is primarily a function of drainage area, rainfall, and geology. The length of stream that supports various assemblages of species can be differentiated by the elevation of the stream reach and the presence of waterfalls, as identified in Figure 2. The 2001 petitioned streams account for 4.786 miles of potential low elevation (<100 feet elevation) stream habitat (82.0%), while the 2021 petitioned streams represent 1.048 miles of potential low elevation stream habitat (18.0%). Similarly, of the available potential stream habitat including mid-elevation (<600 feet elevation) reaches, the 2001 petitioned streams account for 27.392 miles (73.8%) and the 2021 petitioned streams account for 9.702 miles (26.2%).

[13] Tingley, R.W., Infante, D.M., MacKenzie, R.A., Cooper, A.R., Tsang, Y.-P. (2019). Identifying natural catchment landscape influences on tropical stream organisms: classifying stream reaches of the Hawaiian Islands. *Hydrobiologia*, 826: 67-83.

Table 4. General topographic features affected by surface water delivery systems in East Maui.

Hydrologic Unit	Drainage Area (mi^2)	Maximum Elevation (ft)	Length of longest stream (mi)	Terminal reach	Percent of surface geology as Hana volcanics (%)	Percent of surface geology as Kula volcanics (%)	Percent of surface geology as Honomanū volcanics (%)
Honopou	2.8	2290	7.17	Estuary	0.0	100.0	0.0
Hoʻolawa	3.6	3510	9.37	Estuary	28.2	71.4	0.3
Waipiʻo	0.6	1530	3.12	Waterfall	0.0	95.3	4.7
Hanehoi	1.5	2290	5.14	Waterfall	1.7	95.4	2.7
Hoalua	1.3	3530	7.03	Estuary	21.5	74.0	4.5
Hānawana	0.7	1540	2.75	Waterfall	19.4	75.1	5.4
Kailua	4.9	6550	8.73	Waterfall	59.1	40.5	0.3
Nailiilihaele	3.5	5210	10.6	Waterfall	13.2	85.4	0.4
Puehu	0.49	1680	2.94	Waterfall	0.0	96.6	3.4
ʻOʻopuola	1.0	2060	3.41	Estuary	0.0	96.2	3.6
Kaʻaiea	1.1	2720	5.61	Waterfall	0.0	97.5	2.5
Punaluʻu	0.20	1190	1.62	Waterfall	0.0	90.1	9.9
Kōlea	0.6	1860	2.96	Waterfall	0.0	95.0	5.0
Waikamoi	4.6	9310	12.6	Waterfall	0.8	98.3	0.9
Puohokamoa	3.2	5640	9.0	Estuary	0.0	99.3	0.7
Haʻipuaʻena	1.6	6030	8.98	Waterfall	0.0	99.8	0.2
Punalau	1.1	2560	3.77	Estuary	0.0	89.8	9.9
Honomanū	5.4	8310	9.82	Estuary	0.0	88.9	11.1
Nuaʻailua	1.6	2420	3.61	Estuary	3.2	78.1	17.8
Piʻinaʻau	20.5	10010	16.0	Estuary	56.0	32.0	5.7
Waiokamilo	2.7	6490	9.34	Waterfall	48.5	41.8	4.9
Wailuanui	6.6	8860	12.2	Estuary	30.5	58.1	4.7
West Wailuaiki	4.1	8840	8.78	Estuary	0.2	98.4	1.3
East Wailuaiki	3.9	8500	8.48	Estuary	0.9	97.6	1.4
Kopiliʻula	4.8	8320	8.43	Estuary	31.1	67.8	1.0
Waiohue	1.4	4000	2.95	Estuary	23.1	75.5	0.6
Paʻakea	0.7	2190	5.46	Estuary	53.7	46.3	0.0
Waiaaka	0.14	1640	1.47	Estuary	0.7	94.7	4.4
Kapaula	0.8	2660	3.43	Estuary	34.9	64.6	0.6
Hānawī	5.7	8070	8.02	Estuary	59.4	40.6	0.1
Makapipi	5.3	7620	6.14	Waterfall	94.8	5.2	0.0

Table 5. General hydrologic features of streams and their main tributaries affected by surface water delivery systems in East Maui including available flow (regulated or natural) at 1250ft. [note: -- not available, watershed was too small for evaluation]

Hydrologic Unit	Estimated Q_{50} at ~1250 ft elevation (cfs)	Estimated Q_{50} gain at ~700 ft elevation from ~1250 ft elevation (cfs)	Length of stream below 100 ft elevation (mi)	Length of stream below 600 ft elevation (mi)
Honopou	2.0	0.18	0.552	4.330
Hoʻolawa	--	--	0.338	2.631
Hoolawaliilii	3.3	1.2	--	--
Hoolawanui	3.0	0.81	--	--
Mokupapa	--	--	0.115	1.915
Waipiʻo	0.73	0.27	0.000	1.066
Hanehoi	2.0		0.228	2.629
Hoalua	1.3	1.5	0.193	0.860
Hanawana	--	0.44	0.117	0.799
Kailua	7.8	0.55	0.000	1.013
Oanui	1.7	--	--	--
Nailiilihaele	13	0.53	0.000	0.959
Puehu	--		0.069	1.249
ʻOʻopuola	1.0	0.09	0.216	1.021
Kaʻaiea	3.8	0.27	0.000	0.647
Punaluʻu	--	0.48	0.000	0.491
Kōlea	--	0.55	0.000	0.708
East Kōlea	0.30	--	--	--
West Kōlea	0.65	--	--	--
Waikamoi	6.6	0.61	0.000	0.805
Alo	2.5	--		
Waihinepee	--	0.89	0.000	0.675
Puohokamoa	8.7	0.30	0.103	0.731
Haʻipuaʻena	4.8	0.39	0.000	0.807
Punalau	6.0	0.99	0.239	0.567
Honomanū	3.8	--	0.790	1.479
Nuaʻailua	0.46	--	0.390	1.089
Piʻinaʻau	0.38	--	0.531	5.843
Palauhulu	5.4	--	--	--
Waiokamilo	6.1	--	0.071	2.118
Wailuanui	--	--	0.650	0.965
East Wailuanui	3.1	--	--	--
West Wailuanui	3.8	--	--	--
West Wailuaiki	8.9	--	0.197	0.571
East Wailuaiki	7.7	--	0.263	0.614
Kopiliʻula	6.6	--	0.044	0.909
Puaʻakaʻa	0.97	--	--	--
Waiohue	5.2	--	0.135	0.496
Paʻakea	1.5	--	0.073	0.806
Waiaʻaka	0.86	--	0.000	0.319
Kapaula	4.3	--	0.024	0.554
Hānawī	6.2	--	0.091	0.815
Makapipi	unknown	--	0.166	0.959

Table 6. Total modeled habitat units (m^2) and percentage of total (%) in East Maui under natural conditions and following implementation of the Commission's 2018 Decision for the original 2001 petitioned streams and the 2021 petitioned streams.

Scenario	2001 Petitioned Streams modeled habitat units	2021 Petitioned Streams modeled habitat units	total
Natural Conditions	1,392,812 (66.0%)	717,242 (34.0%)	2,110,054 (100.0%)
2018 Decision & Order	1,075,132 (51.0%)	94,092 (4.5%)	1,169,224 (55.5%)

Figure 2. Stream reach lengths in the East Maui that have the potential to support low-elevation freshwater species (below 100 feet in elevation) (A) and mid-elevation freshwater species (below 600 feet in elevation) (B).

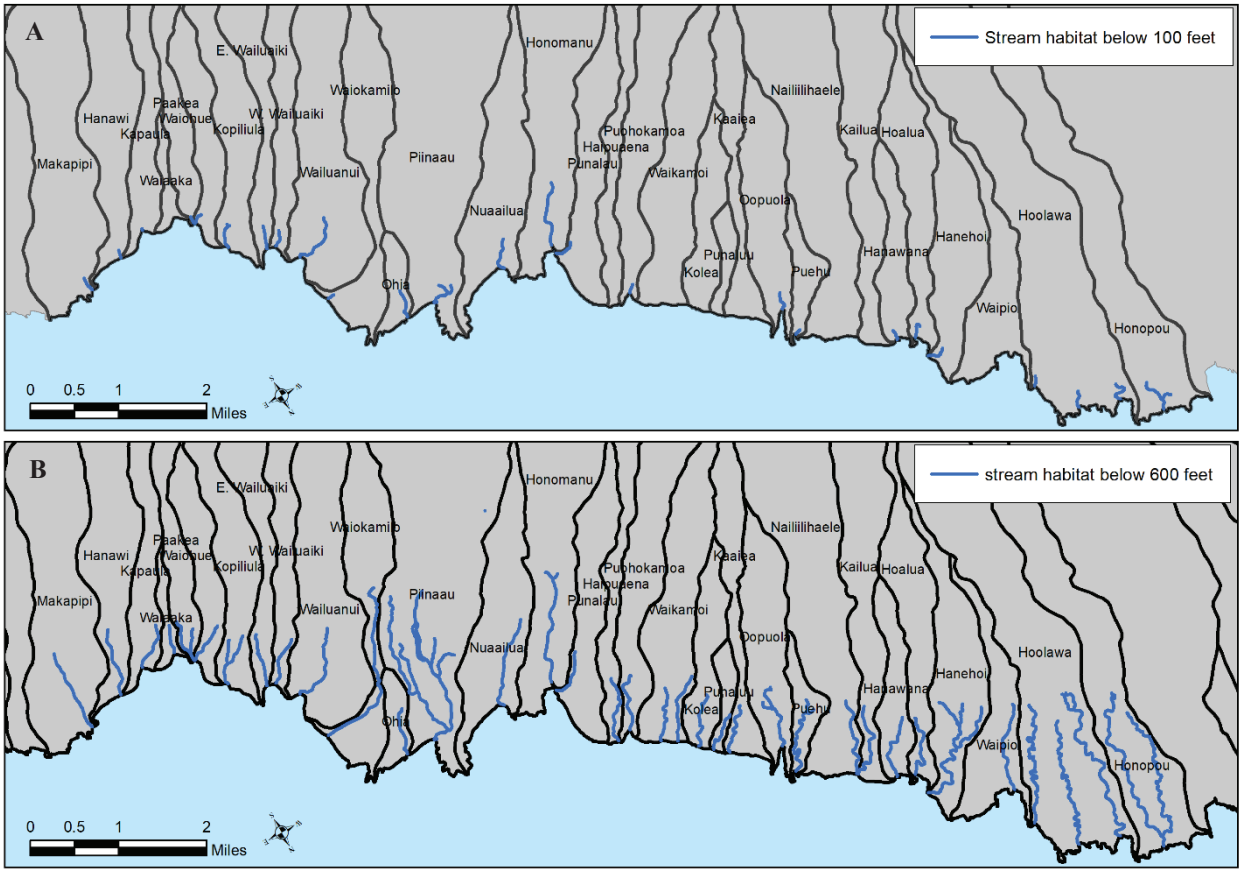
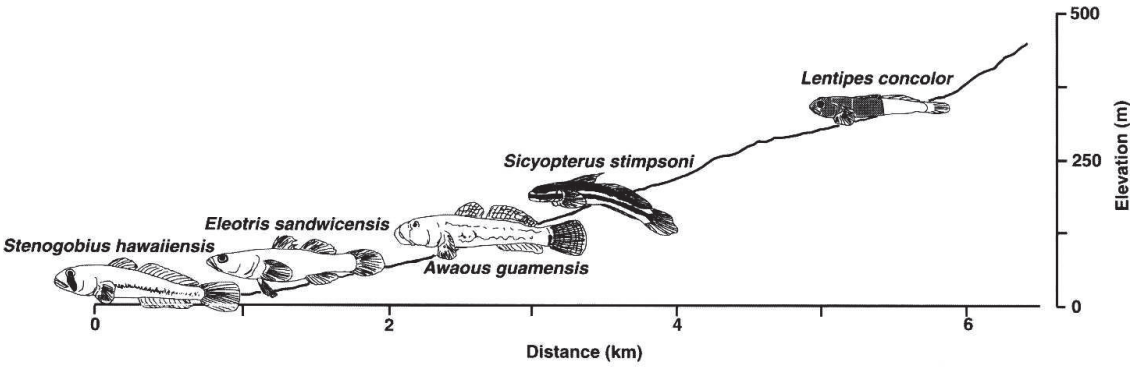


Table 7. Total modeled habitat units, percent of total habitat units in license area streams, and historical presence of native stream biota by stream in East Maui.

Stream	Habitat Units	Percent of Total	*Eleotris sandwicensis*	*Stenogobius hawaiiensis*	*Awaous stamineus*	*Sicyopterus stimpsoni*	*Lentipes concolor*	*Neritina granosa*	*Neritina vespertinus*	*Macrobrachium grandimanus*	*Atyoida bisulcata*
Honopou	92,546	4.4%	X		X	X	X				X
Hoʻolawa	225,737	10.7%	X		X						X
Mokupapa	0	0.0%									
Waipiʻo	3,211	0.2%									
Hanehoi	28,009	1.3%									X
Hoalua	24,959	1.2%									
Hānawana	2,633	0.1%									
Kailua	130,209	6.2%				X					X
Nailiilihaele	275,924	13.1%					X				X
Puehu	0	0.0%									
ʻOʻopuola	20,616	1.0%					X				
Kaʻaiea	28,013	1.3%									X
Punaluʻu	0	0.0%									
Kōlea	5,940	0.3%									
Waikamoi	40,068	1.9%									X
Waihinepeʻe	0	0.0%									
Puhokamoa	189,132	9.0%			X	X	X				X
Haʻipuaʻena	40,496	1.9%					X				X
Punalau	14,527	0.7%			X	X	X				X
Honomanū	108,859	5.2%	X	X	X	X	X	X			X
Nuaʻailua	54,106	2.6%	X	X	X	X	X	X	X		X
Piʻinaʻau	349,196	16.5%	X	X	X	X	X	X	X	X	X
Waiokamilo	37,792	1.8%			X						X
Wailuanui	46,240	2.2%	X		X		X				X
West Wailuaiki	38,754	1.8%			X		X				X
East Wailuaiki	60,737	2.9%	X		X		X				X
Kopiliʻula	80,507	3.8%	X		X		X	X			X
Waiohue	18,459	0.9%	X	X	X	X	X	X	X	X	X
Paʻakea	17,270	0.8%			X		X	X			
Waiaaka	0	0.0%									
Kapaula	25,418	1.2%									
Hānawī	126,408	6.0%	X	X	X	X	X	X			X
Makapipi	24,288	1.2%	X		X	X	X	X			X

Figure 3. Elevational profile of a terminal-estuary stream on the Big Island of Hawaii (Hakalau Stream). (Source: McRae, 2007, adapted from Nishimoto and Kuamoo, 1991)

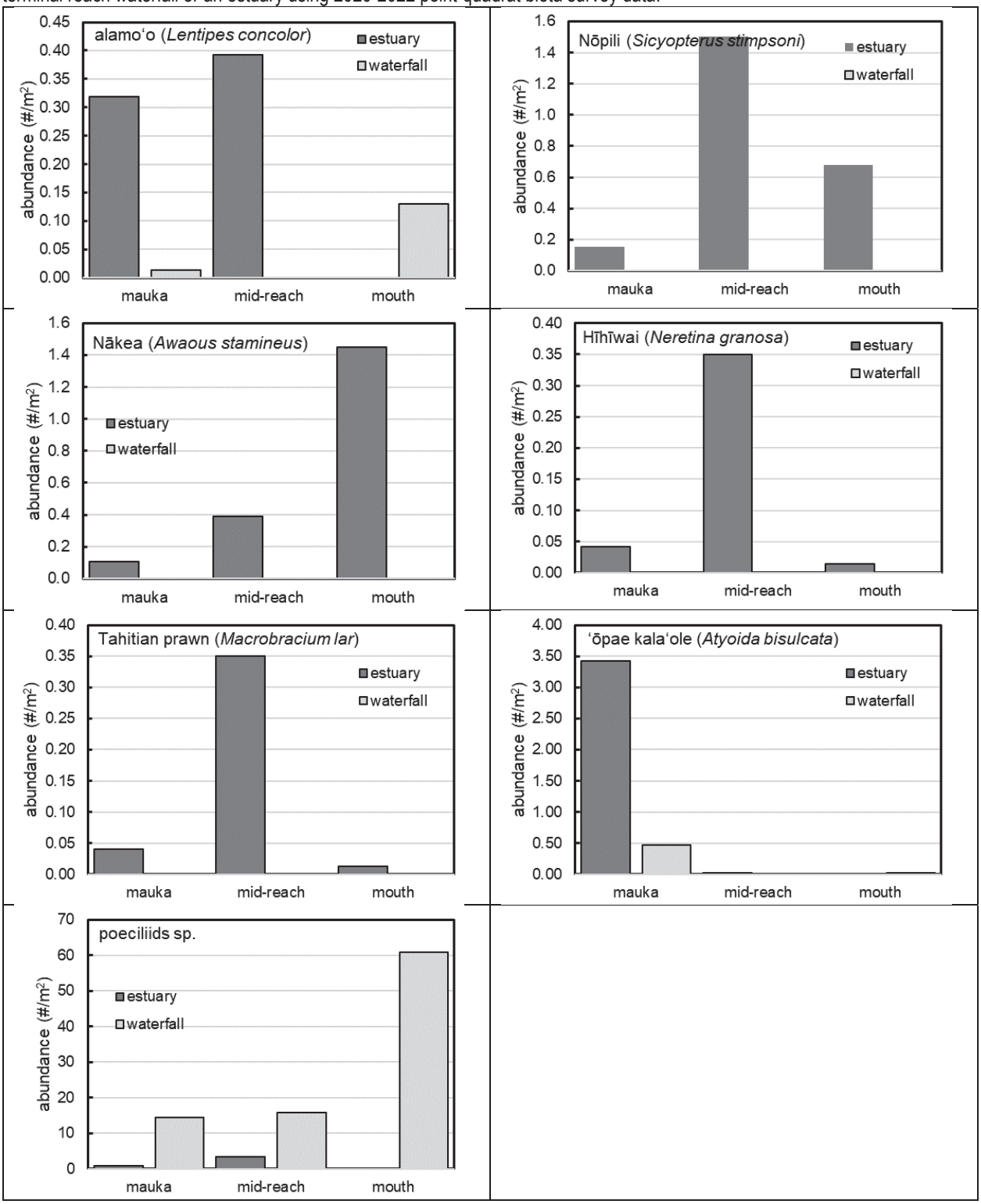


HYDROLOGIC UNIT SUMMARIES

A comprehensive assessment of instream and non-instream uses of water is provided in the Instream Flow Standard Assessment Report (IFSAR) for each hydrologic unit. The following is a summary of these data by hydrologic unit, including estimates of the hydrological characteristics of the stream, the seepage gains and losses from high elevation to low elevation, and a generalized schematic diagram of the stream, its tributaries, the registered stream diversions, and their relationship to hydrological characteristics.

Among streams in the 2021 Petition, some of the streams support recreational uses, some support aquatic ecosystems, and some support riparian uses.

Figure 4. Density of native and non-native species at low- (mouth), mid-, and high- (mauka) elevation reaches for streams with a terminal reach waterfall or an estuary using 2020-2022 point-quadrat biota survey data.



KŌLEA (HYDROLOGIC UNIT 6046)

Watershed Characteristics:
Area: 0.6 mi^2
Maximum elevation: 1864 ft
Land Use: 26.1% agriculture; 73.9% conservation
Total Stream Length: 1.8 mi
Terminal Order: 1
Terminal Reach: Waterfall-tidal plunge pool with chute

Table 8. Low-flow characteristics from partial-record gaging stations in the Kōlea hydrologic unit. [all values in cubic feet per second, cfs (million gallons per day, mgd)]

Station ID	site name	Period of Record	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
PR-1	East Kōlea abv Wailoa Ditch	1984-2013	0.30 (0.19)	0.26 (0.17)	0.23 (0.15)	0.19 (0.12)	0.16 (0.10)	0.14 (0.09)	0.12 (0.08)	0.10 (0.06)	0.08 (0.05)	0.06 (0.04)
PR-2	West Kōlea abv Wailoa Ditch	1984-2013	0.65 (0.42)	0.56 (0.36)	0.48 (0.31)	0.41 (0.26)	0.35 (0.23)	0.29 (0.19)	0.25 (0.16)	0.21 (0.14)	0.17 (0.11)	0.13 (0.08)

Biotic Information:
Terminal reach waterfall without plunge pool
No native species observed in 16 site visits
20 point-quadrant biota surveys conducted at 710ft elevation at 0.42 cfs; with flow restored past Center Ditch since 2016; no native species observed;
Magalagrion pacificum (endangered) observed in East Kōlea above Wailoa Ditch (~1300ft), previously thought to be restricted to East Wailuaiki

Historic Rankings:
Potential Heritage Stream: No
Hawaii Stream Assessment Rank: none
US Fish and Wildlife Service High Quality Stream: No
The Nature Conservancy Priority Aquatic Sites: No
National Park Service Nationwide Rivers Inventory: No

Watershed Rating:
Landcover: 9/10
Shallow Waters Rating: 0/10
Stewardship Rating: 4/10
Size Rating: 1/10
Wetness Rating: 6/10
Reach Diversity Rating: 2/10
Total Watershed Rating: 5/10

Notes: bamboo invading from east, dominating riparian vegetation from 600ft to >1300ft.

Biological Rating:
Native Species Rating: not ranked
Introduced Genera Rating: not ranked
All Species Score: not ranked
Total Biological Rating: not ranked
Overall Rating: not ranked
Rating Strength: 0/10

Hawaii Stream Assessment
HSA aquatic resources: not ranked
HSA riparian resources: detrimental animals (pigs); 0% native forest
HSA cultural resources: not surveyed
HSA recreational resources: nothing; ranked a "4" by regional committee

Registered Diversions
DIV 156 EAST MAUI IRR: W-3 Wailoa Ditch from East Kolea Stream
DIV 157 EAST MAUI IRR: W-4 Wailoa Ditch from West Kolea Stream
DIV 209 EAST MAUI IRR: NH-2 New Hamakua Ditch from East Kolea Stream
DIV 208 EAST MAUI IRR: NH-3 New Hamakua Ditch from West Kolea Stream
DIV 224 EAST MAUI IRR: C-2 Center Ditch from Kolea Stream
DIV 203 EAST MAUI IRR: C-3 Center Ditch from Kolea Stream
DIV 231 EAST MAUI IRR: Kolea Reservoir on Kolea Stream (abandoned and removed)

Table 9. Stream diversions on Kōlea Stream at Wailoa, New Hamakua, and Center ditches, East Maui.

W-3 Wailoa Ditch intake on East Kolea Stream from downstream	NH-2 New Hamakua Ditch intake on East Kolea Stream from upstream
	
W-4 Wailoa Ditch intake on West Kolea Stream from right bank	NH-3 New Hamakua Ditch intake on West Kolea Stream from downstream
	
C-2 Center Ditch intake on Kolea Stream	Kolea Stream mouth
	

Figure 5. Registered diversions in the Kōlea hydrologic unit, East Maui

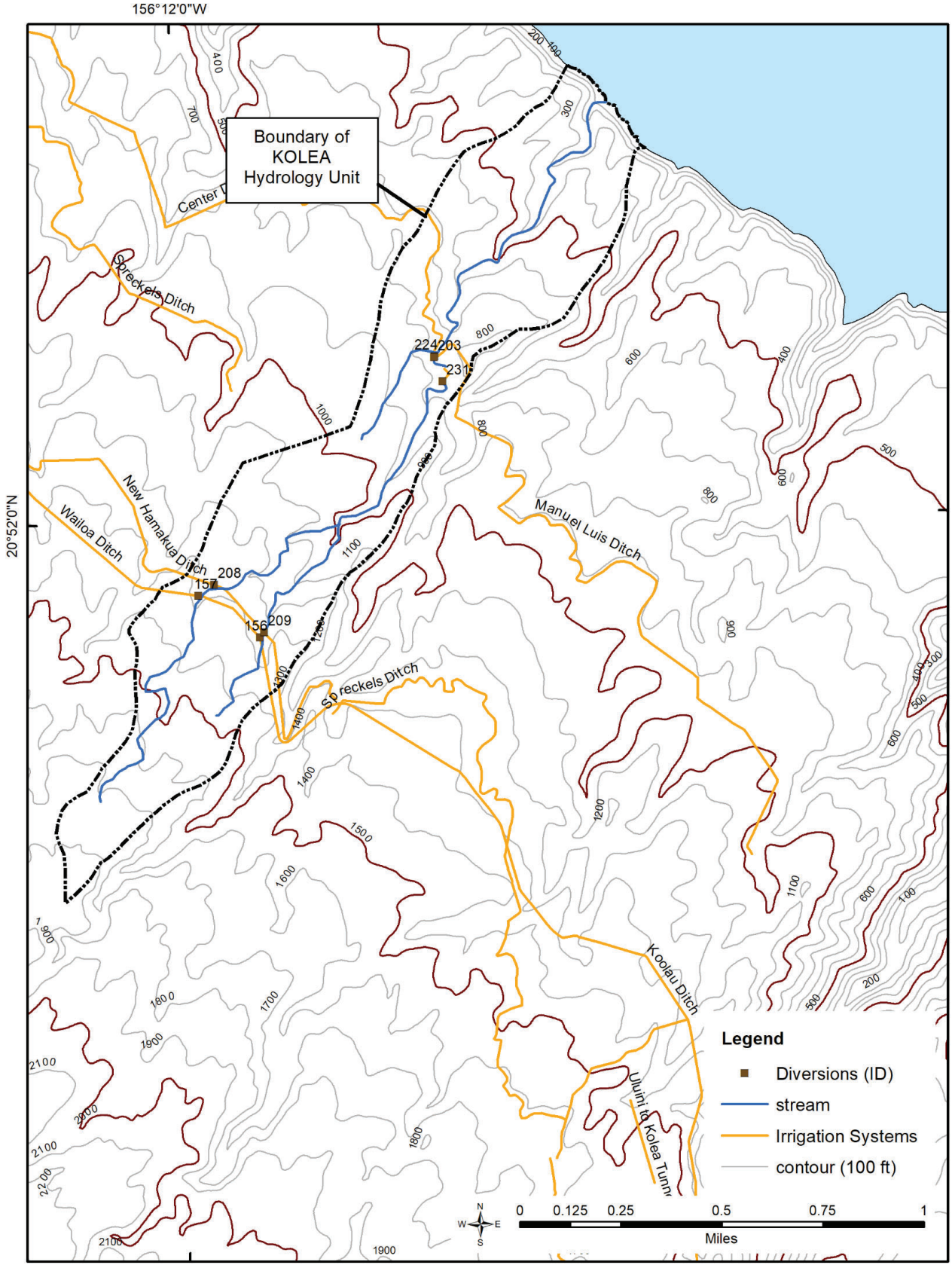


Figure 6. Seepage run results on Kōlea Stream in the Kolea hydrologic unit, East Maui

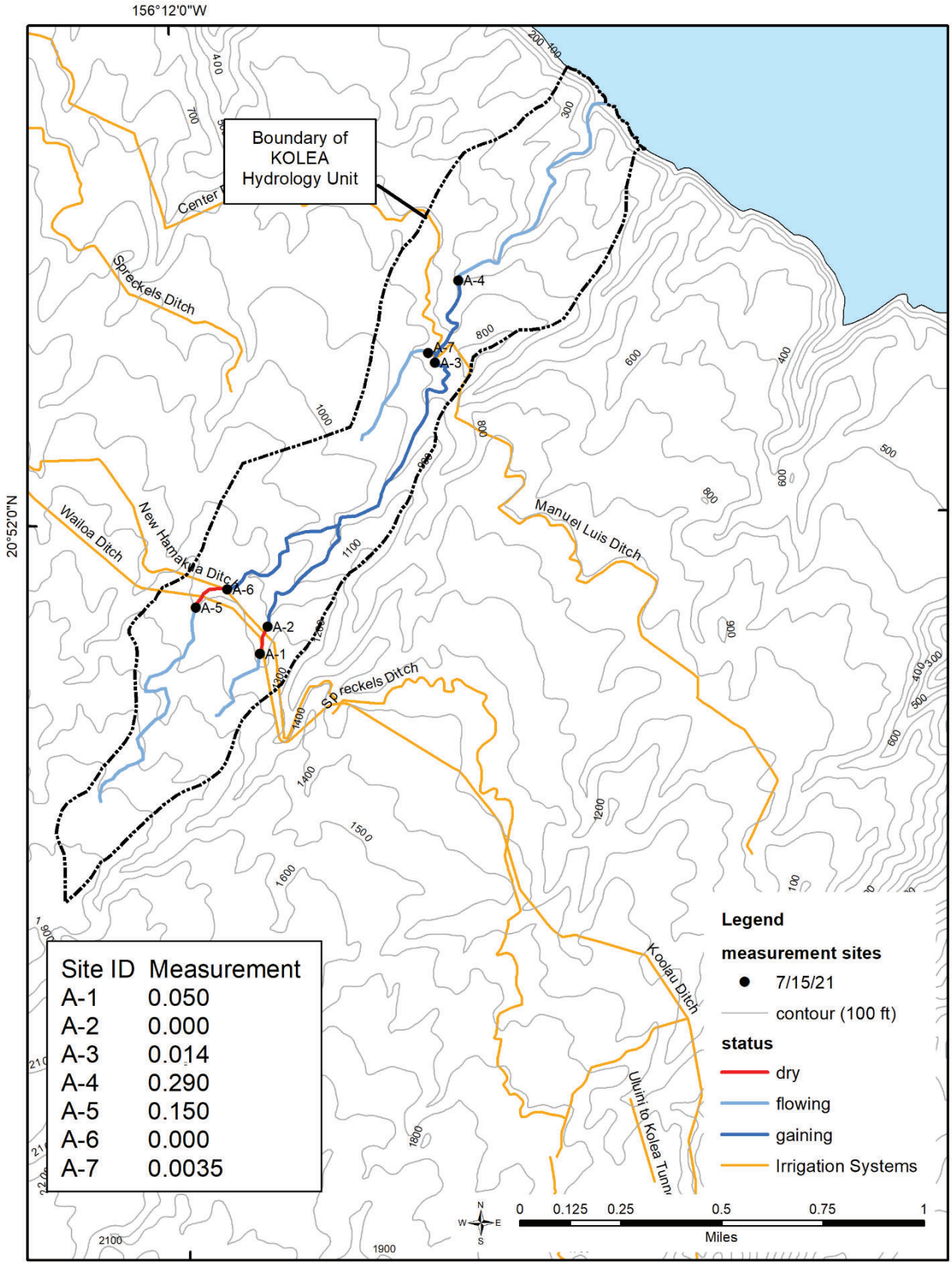
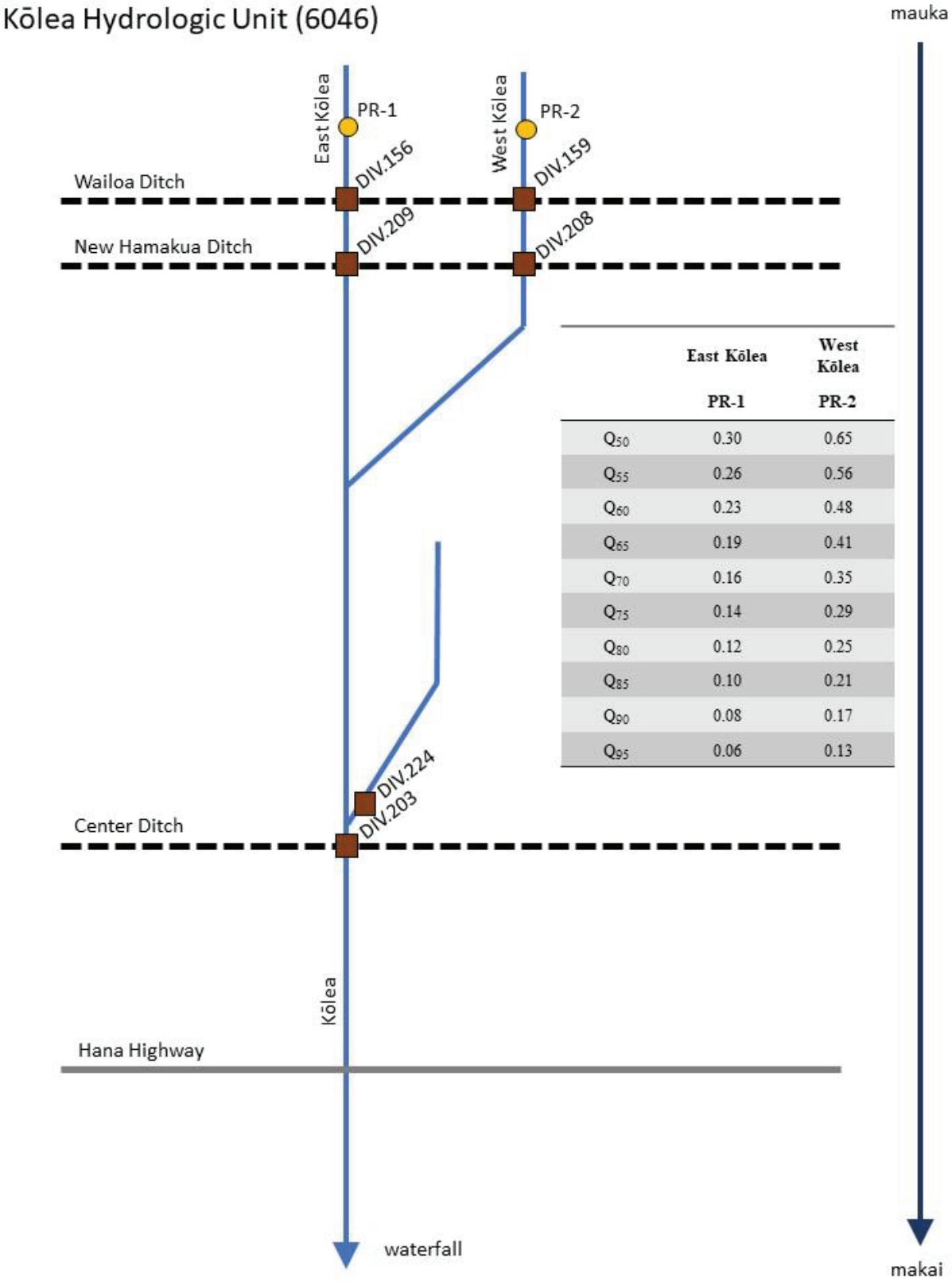


Figure 7. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions and the location of the partial-record (PR) gaging stations (flows in cubic feet per second) in the Kōlea hydrologic unit.



	East Kōlea PR-1	West Kōlea PR-2
Q_{50}	0.30	0.65
Q_{55}	0.26	0.56
Q_{60}	0.23	0.48
Q_{65}	0.19	0.41
Q_{70}	0.16	0.35
Q_{75}	0.14	0.29
Q_{80}	0.12	0.25
Q_{85}	0.10	0.21
Q_{90}	0.08	0.17
Q_{95}	0.06	0.13

PUNALU‘U (HYDROLOGIC UNIT: 6045)

Watershed Characteristics:
Area: 0.20 mi^2
Maximum elevation: 1190 ft
Land Use:
Total Stream Length: 1.62 mi
Terminal Order: 1
Terminal Reach: Waterfall-plunge

Table 10. Low-flow characteristics from partial-record gaging stations in the Punalu‘u hydrologic unit. [all values in cubic feet per second, cfs]

Station ID	site name	Period of Record	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
PR-3	Punalu‘u Stream abv Center Ditch	1984-2013	0.48 (0.31)	0.43 (0.28)	0.37 (0.24)	0.30 (0.19)	0.27 (0.17)	0.22 (0.14)	0.19 (0.12)	0.15 (0.10)	0.12 (0.78)	0.09 (0.06)

Biotic Information:
Terminal reach waterfall without plunge pool
No native species observed in 15 site visits

Historic Rankings:
Potential Heritage Stream: No
Hawaii Stream Assessment Rank: none
US Fish and Wildlife Service High Quality Stream: No
The Nature Conservancy Priority Aquatic Sites: No
National Park Service Nationwide Rivers Inventory: No

Watershed Rating:
Landcover: not ranked
Shallow Waters Rating: not ranked
Stewardship Rating: not ranked
Size Rating: not ranked
Wetness Rating: not ranked
Reach Diversity Rating: not ranked
Total Watershed Rating: not ranked

Biological Rating:
Native Species Rating: not ranked
Introduced Genera Rating: not ranked
All Species Score: not ranked
Total Biological Rating: not ranked

Overall Rating: not ranked
Rating Strength: not ranked

Hawaii Stream Assessment
HSA aquatic resources: not ranked
HSA riparian resources: not surveyed
HSA cultural resources: not surveyed
HSA recreational resources: not surveyed

Registered Diversions
DIV 222 EAST MAUI IRR: C-4 Center Ditch from Punalu‘u Stream

Table 11. Stream diversions on Punalu‘u Stream at Center ditch, East Maui.

C- 4 Center Ditch intake on Punalu‘u Stream from downstream	C- 4 Center Ditch intake on Punalu‘u Stream from upstream
	
Punalu‘u Stream above Center Ditch looking upstream	Punalu‘u Stream above Center Ditch looking downstream
	
Punalu‘u Stream mouth	Punalu‘u Stream mouth
	

Figure 8. Registered diversions in the Punalu‘u hydrologic unit, East Maui

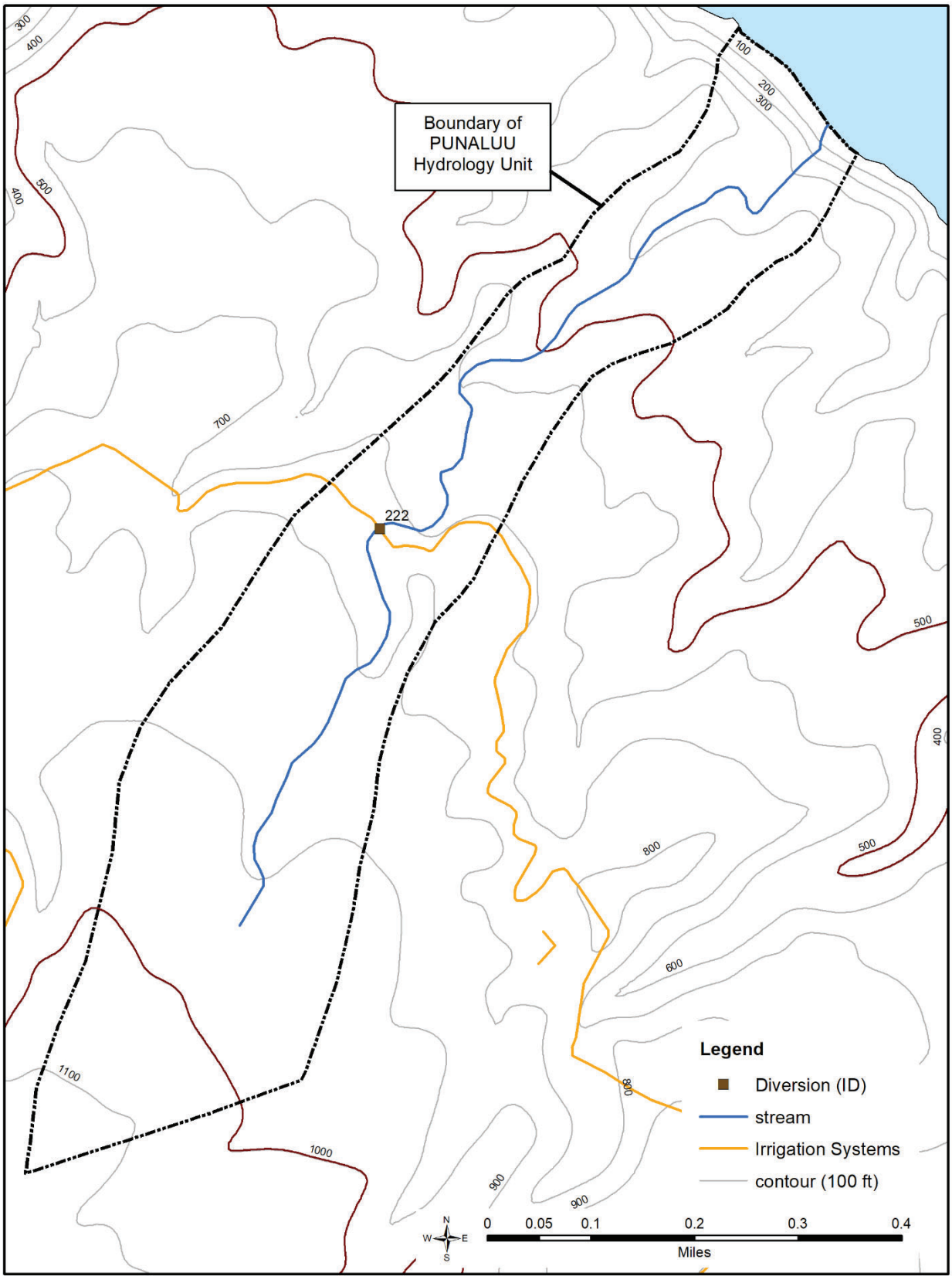
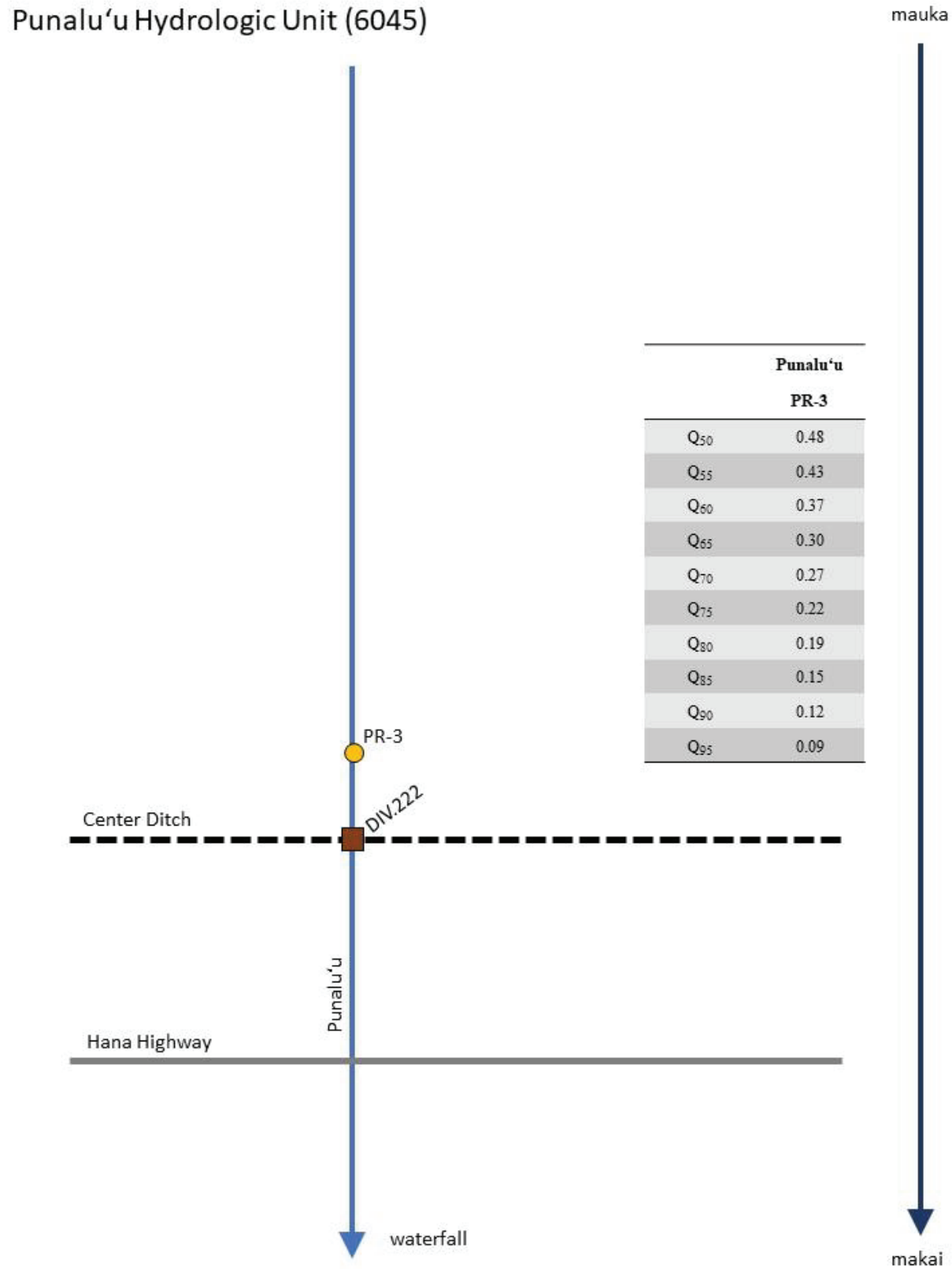


Figure 9. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions and the location of the partial-record (PR) gaging stations (flows in cubic feet per second, cfs) in the Punalu‘u hydrologic unit.



	Punalu‘u PR-3
Q_{50}	0.48
Q_{55}	0.43
Q_{60}	0.37
Q_{65}	0.30
Q_{70}	0.27
Q_{75}	0.22
Q_{80}	0.19
Q_{85}	0.15
Q_{90}	0.12
Q_{95}	0.09

KA‘AIEA (HYDROLOGIC UNIT: 6044)

Watershed Characteristics:
Area: 1.1 mi^2
Maximum elevation: 2717 ft
Land Use: 19.9% agriculture; 80.1% conservation
Total Stream Length: 5.3 mi
Terminal Order: 1
Terminal Reach: Waterfall

Table 12. Low-flow characteristics from continuous and partial-record gaging stations in the Ka‘aiea hydrologic unit.
[all values in cubic feet per second, cfs]

Station ID	site name	Period of Record	Q_{10}	Q_{20}	Q_{30}	Q_{40}	Q_{50}	Q_{60}	Q_{70}	Q_{80}	Q_{90}
16565000	Ka‘aiea Gulch nr Huelo	1922-1961	17	8.8	5.6	3.8	2.9	2.2	1.7	0.94	0.93
16565000	Ka‘aiea Gulch nr Huelo	1984-2013					2.4	1.9	1.3	1.3	0.69

Station ID	site name	Period of Record	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
PR-4	Ka‘aiea Stream abv Wailoa Ditch	1984-2013	3.8 (2.46)	3.2 (2.07)	2.7 (1.75)	2.2 (1.42)	1.8 (1.16)	1.5 (0.97)	1.2 (0.78)	1.0 (0.65)	0.79 (0.51)	0.57 (0.37)

Biotic Information:
Terminal reach waterfall without plunge pool
20 point-quadrant biota surveys conducted at 680ft elevation at 0.01 cfs, no native species observed.
Opae observed at 1250ft above Wailoa Ditch
No other native species observed in 19 site visits

Biological Rating:
Native Species Rating: not ranked
Introduced Genera Rating: not ranked
All Species Score: not ranked
Total Biological Rating: not ranked
Overall Rating: not ranked
Rating Strength: not ranked

Historic Rankings:
Potential Heritage Stream: No
Hawaii Stream Assessment Rank: none
US Fish and Wildlife Service High Quality Stream: No
The Nature Conservancy Priority Aquatic Sites: No
National Park Service Nationwide Rivers Inventory: No

Hawaii Stream Assessment
HSA aquatic resources: not ranked
HSA riparian resources: detrimental plants (hau); detrimental animals (pigs); 10% native forest
HSA cultural resources: not surveyed
HSA recreational resources: hiking, swimming, scenic views; ranked a “2” by regional committee

Watershed Rating:
Landcover: not ranked
Shallow Waters Rating: not ranked
Stewardship Rating: not ranked
Size Rating: not ranked
Wetness Rating: not ranked
Reach Diversity Rating: not ranked
Total Watershed Rating: not ranked

Registered Diversions
DIV 146 EAST MAUI IRR: W-6 Wailoa Ditch from Ka‘aiea Stream
DIV 232 EAST MAUI IRR: S-11 Spreckels Ditch from Ka‘aiea Stream
DIV 194 EAST MAUI IRR: C-5 Center Ditch from Ka‘aiea Stream

Table 13. Stream diversions on Ka‘aiea Stream at Wailoa, Spreckels, and Center ditches, East Maui.

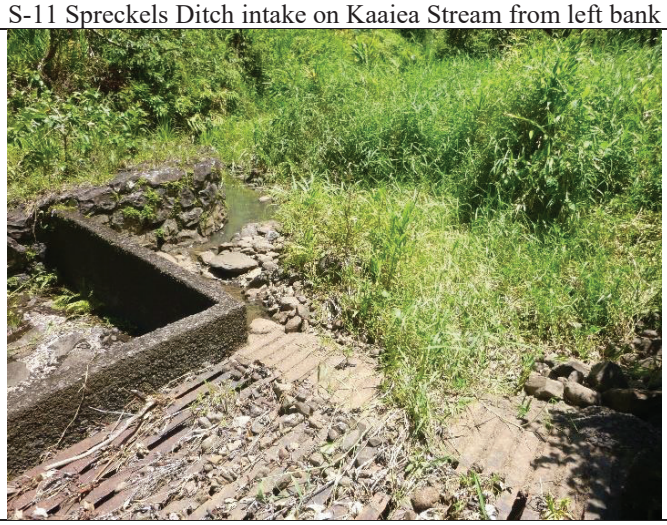
W-6 Wailoa Ditch intake on Kaaiea Stream	S-11 Spreckels Ditch intake on Kaaiea Stream from left bank
	
S-11 Spreckels Ditch intake on Kaaiea Stream from upstream right bank	C-5 Center Ditch intake on Kaaiea Stream from left bank
	
C-5 Center Ditch intake on Kaaiea Stream from downstream	Kaaiea mouth
	

Figure 10. Registered diversions in the Ka‘aiea hydrologic unit, East Maui.

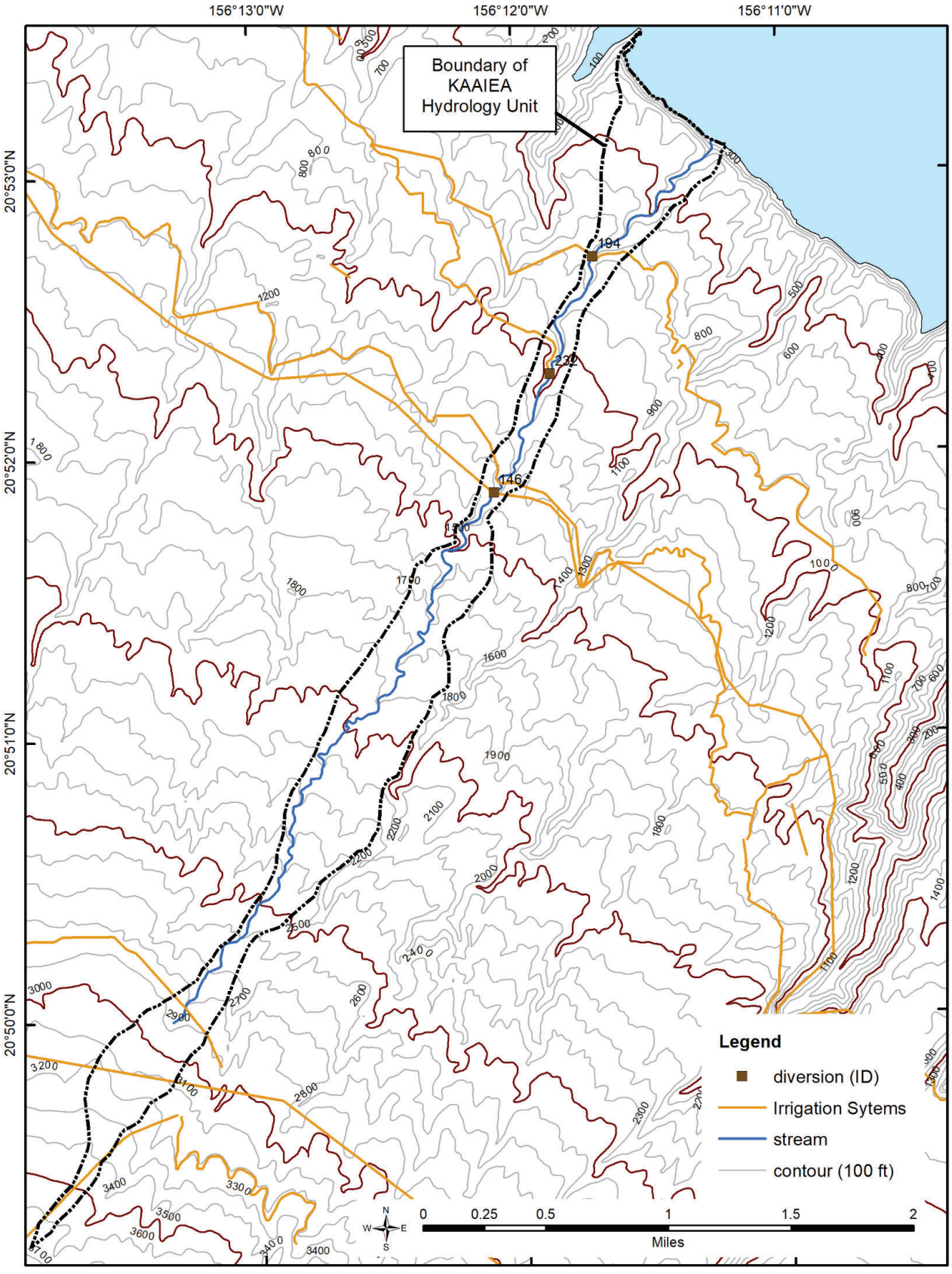


Figure 11. Seepage run results in the Ka'aiea hydrologic unit, East Maui.

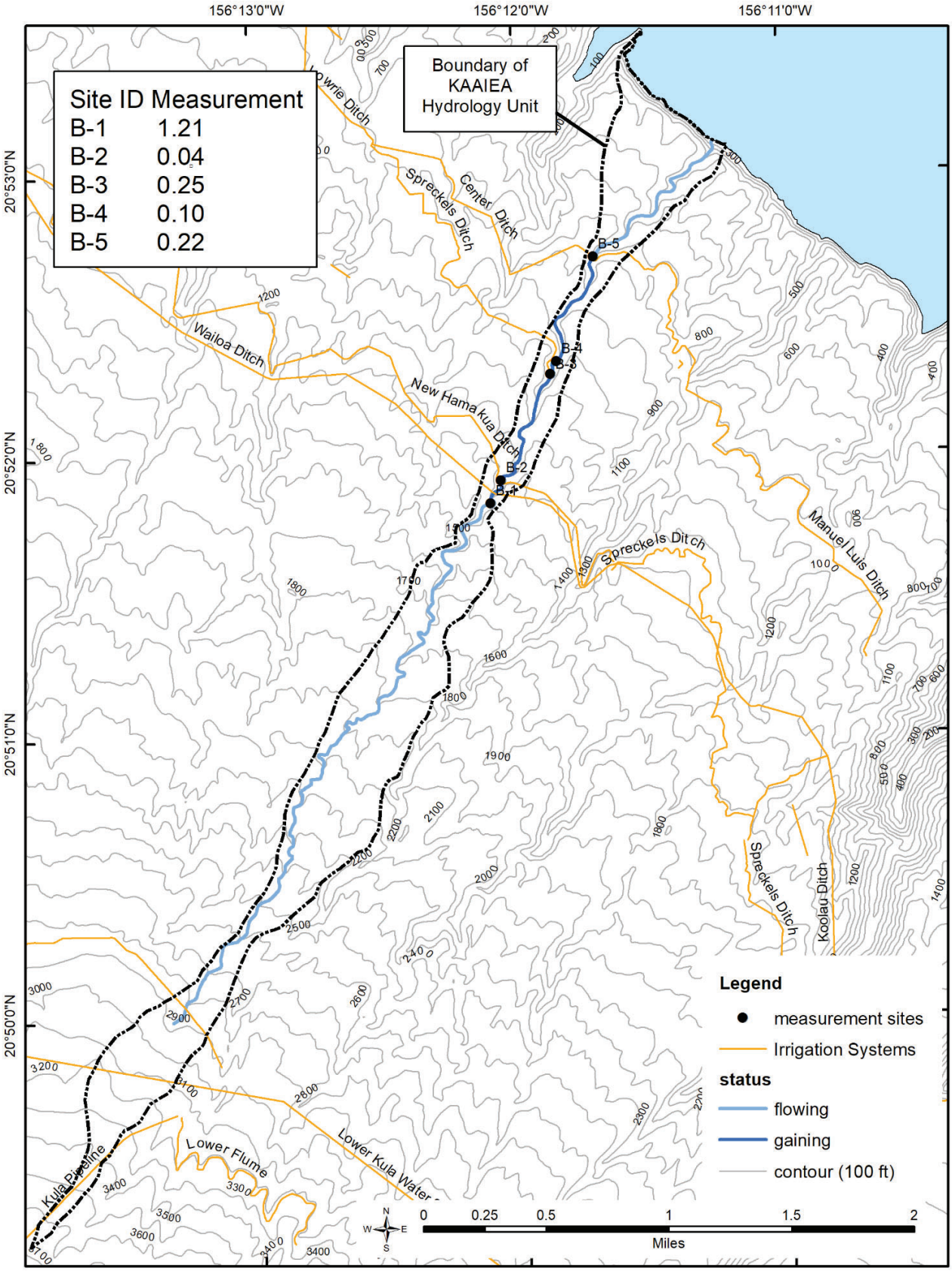
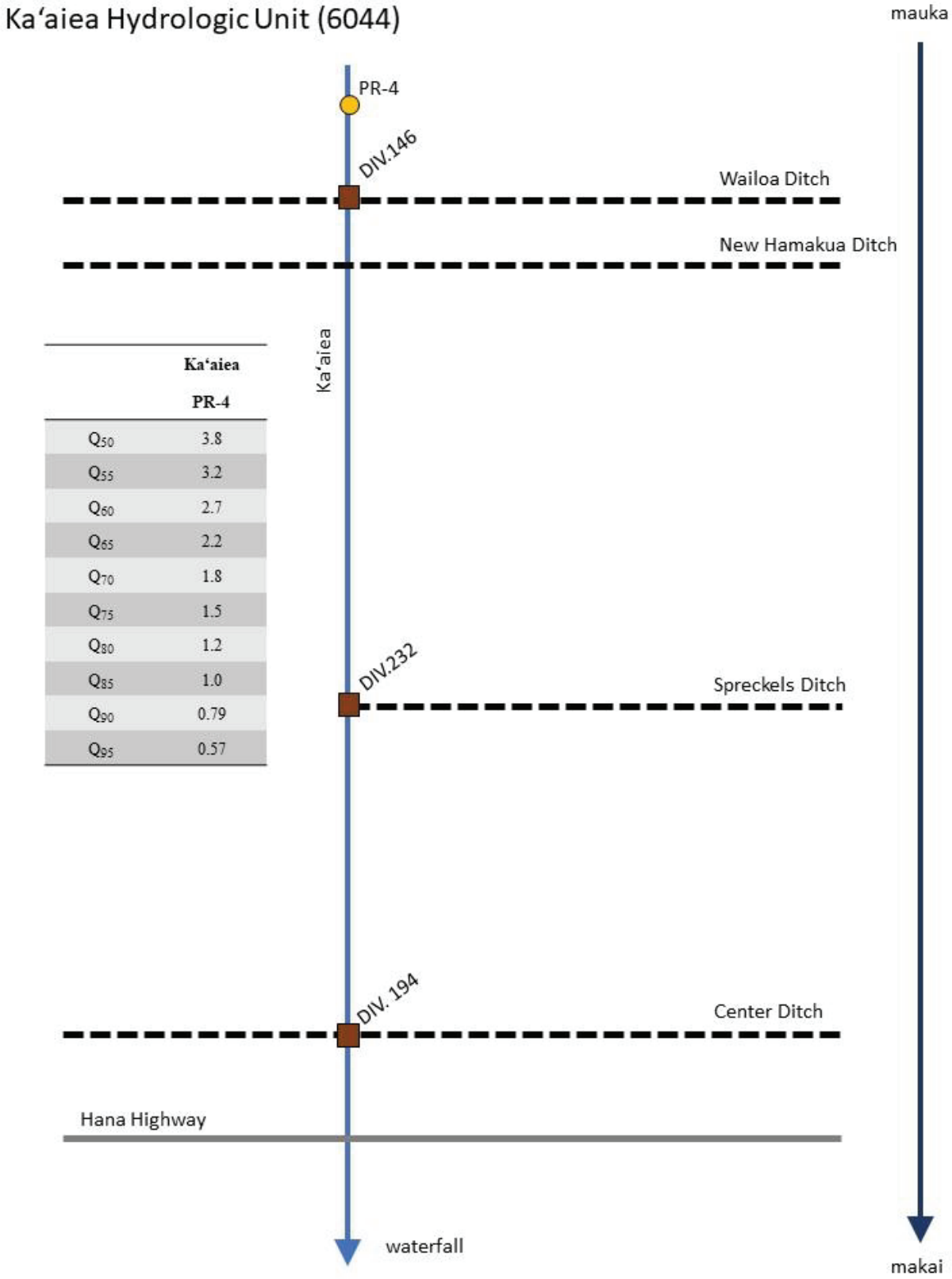


Figure 12. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions and the location of the partial-record (PR) gaging stations (flows in cubic feet per second) in the Ka‘aiea hydrologic unit.



	Ka‘aiea PR-4
Q_{50}	3.8
Q_{55}	3.2
Q_{60}	2.7
Q_{65}	2.2
Q_{70}	1.8
Q_{75}	1.5
Q_{80}	1.2
Q_{85}	1.0
Q_{90}	0.79
Q_{95}	0.57

‘O‘OPUOLA (HYDROLOGIC UNIT: 6043)

Watershed Characteristics:
Area: 1.0 mi^2
Maximum elevation: 2057 ft
Land Use: 27.7% agriculture; 72.3% conservation
Total Stream Length: 4.4 mi
Terminal Order: 2
Terminal Reach: Estuary

Table 14. Low-flow characteristics from continuous and partial-record (PR) gaging stations in the O‘opuola hydrologic unit. [all values in cubic feet per second, cfs]

Station ID	name	Period of Record	Q_{10}	Q_{20}	Q_{30}	Q_{40}	Q_{50}	Q_{60}	Q_{70}	Q_{80}	Q_{90}
16566000	‘O‘opuola Stream nr Huelo	1922-1961	6.2	3.4	2.2	1.5	1.1	0.85	0.62	0.46	0.32
16566000	‘O‘opuola Stream nr Huelo	1984-2013					0.95	0.69	0.50	0.36	0.26

Station ID	site name	Period of Record	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
PR-5	Makanali Stream abv Wailoa Ditch	1984-2013	0.28 (0.18)	0.26 (0.17)	0.23 (0.15)	0.20 (0.13)	0.18 (0.12)	0.15 (0.10)	0.13 (0.08)	0.11 (0.07)	0.08 (0.05)	0.05 (0.03)
PR-6	‘O‘opuola Stream abv Wailoa Ditch	1984-2013	1.0 (0.65)	0.92 (0.59)	0.82 (0.53)	0.72 (0.47)	0.63 (0.41)	0.55 (0.36)	0.48 (0.31)	0.42 (0.27)	0.35 (0.23)	0.28 (0.18)
PR-7	‘O‘opuola Tributary abv Wailoa Ditch	1984-2013	0.24 (0.16)	0.21 (0.14)	0.19 (0.12)	0.16 (0.10)	0.14 (0.09)	0.12 (0.08)	0.11 (0.07)	0.09 (0.06)	0.08 (0.05)	0.06 (0.04)
PR-8	West ‘O‘opuola Stream abv Wailoa Ditch	1984-2013	0.36 (0.23)	0.32 (0.21)	0.29 (0.19)	0.26 (0.17)	0.23 (0.15)	0.21 (0.14	0.19 (0.12)	0.17 (0.11)	0.14 (0.09)	0.12 (0.08)

Biotic Information:
Terminal reach estuary
2008 DAR point quadrat survey
20 point-quadrant biota surveys conducted at 600ft with flow restored past Center Ditch since 2016; o‘opu alamo‘o observed

Historic Rankings:
Potential Heritage Stream: No
Hawaii Stream Assessment Rank: none
US Fish and Wildlife Service High Quality Stream: No
The Nature Conservancy Priority Aquatic Sites: No
National Park Service Nationwide Rivers Inventory: No

Watershed Rating:
Landcover: 9/10
Shallow Waters Rating: 1/10
Stewardship Rating: 5/10
Size Rating: 2/10
Wetness Rating: 7/10
Reach Diversity Rating: 3/10
Total Watershed Rating: 7/10

Biological Rating:
Native Species Rating: not ranked
Introduced Genera Rating: not ranked
All Species Score: not ranked
Total Biological Rating: not ranked
Overall Rating: not ranked
Rating Strength: 1/10

Hawaii Stream Assessment
HSA aquatic resources: not ranked
HSA riparian resources: Detrimental plants (hau); Detrimental animals (pigs); 0% native forest;
HSA cultural resources: not surveyed
HSA recreational resources: hiking, hunting, scenic views; 2 high quality experiences; ranked a “2” by regional committee

Registered Diversions

DIV 173 EAST MAUI IRR: W-7 Wailoa Ditch from Makanali Stream
DIV 171 EAST MAUI IRR: W-8 Wailoa Ditch from Oopuola Stream
DIV 150 EAST MAUI IRR: W-9 Wailoa Ditch from Oopuola Stream
DIV 142 EAST MAUI IRR: W-10 Wailoa Ditch from Oopuola Stream
DIV 275 EAST MAUI IRR: NH-4 New Hamakua Ditch from Makanali Stream
DIV 263 EAST MAUI IRR: NH-5 New Hamakua Ditch from Oopuola Stream
DIV 262 EAST MAUI IRR: NH-6 New Hamakua Ditch from Oopuola Stream
DIV 261 EAST MAUI IRR: NH-7 New Hamakua Ditch from Oopuola Stream
DIV 260 EAST MAUI IRR: NH-8 New Hamakua Ditch from Oopuola Stream
DIV 307 EAST MAUI IRR: S-12 Spreckels Ditch from Makanali Stream
DIV 308 EAST MAUI IRR: S-13 Spreckels Ditch from Oopuola Stream
DIV 316 EAST MAUI IRR: S-14 Spreckels Ditch from West Oopuola Stream
DIV 199 EAST MAUI IRR: C-6 Center Ditch from Makanali Stream
DIV 196 EAST MAUI IRR: C-7 Center Ditch from Oopuola Stream
DIV 195 EAST MAUI IRR: C-8 Center Ditch from West Oopuola Stream

Table 15. Stream diversions on Makanali Stream at Wailoa, New Hamakua, Spreckels, and Center ditches, East Maui.

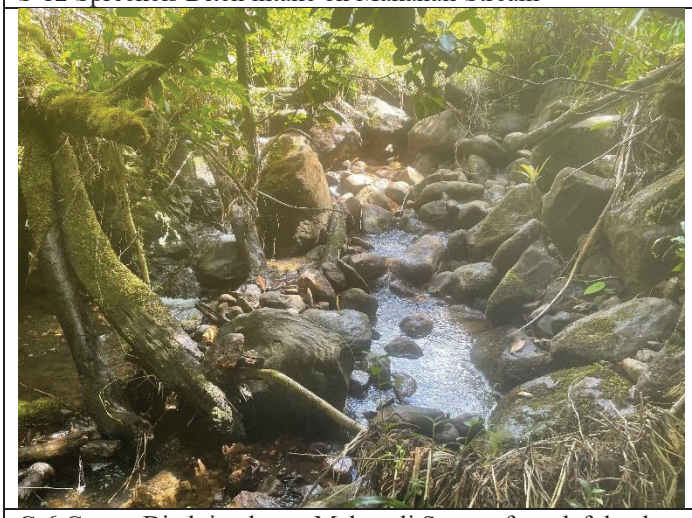
W-7 Wailoa Ditch intake on Makanali Stream	NH-4 New Hamakua Ditch intake on Makanali Stream from left bank
	
S-12 Spreckels Ditch intake on Makanali Stream	S-13 Spreckels Ditch intake on Makanali Tributary
	
C-6 Center Ditch intake on Makanali Stream from left bank	
	

Table 16. Stream diversions on O'opuola Stream at Wailoa, New Hamakua, Spreckels, and Center ditches, East Maui.

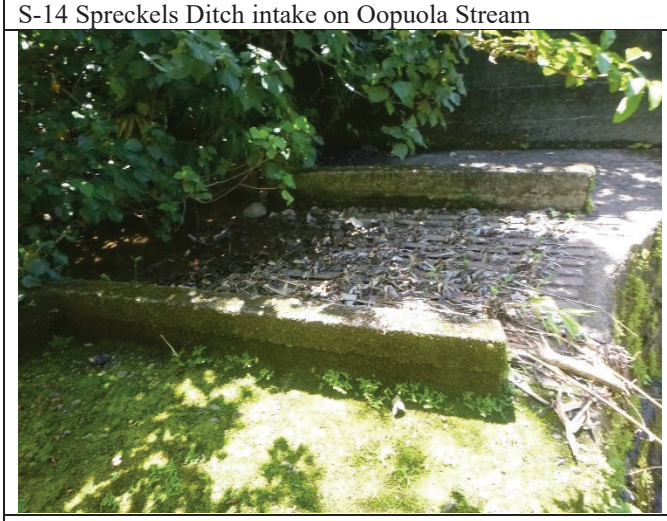
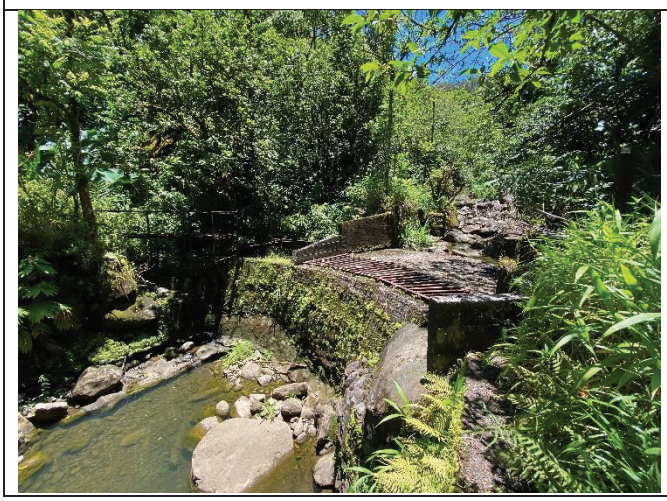
W-8 Wailoa Ditch intake on Oopuola Stream	NH-5 New Hamakua Ditch intake on Oopuola Stream from downstream
	
S-14 Spreckels Ditch intake on Oopuola Stream	S-13 Spreckels Ditch intake on Oopuola Stream
	
	

Table 17. Stream diversions on O‘opuola Tributary and West O‘opuola stream at Wailoa and New Hamakua, East Maui.

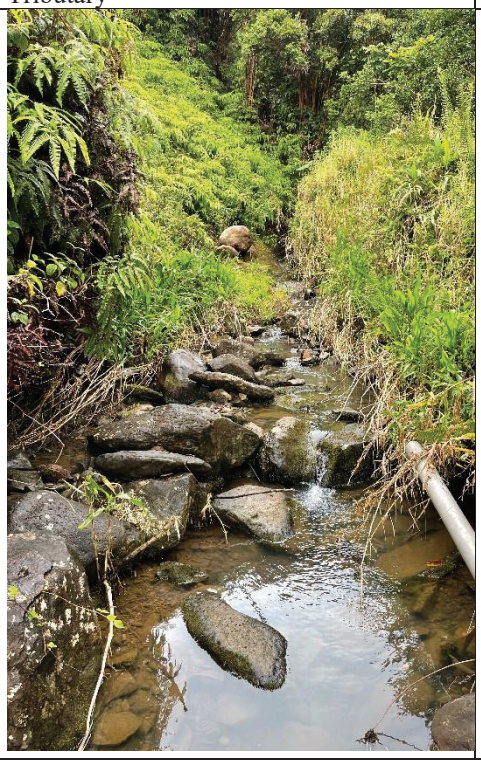
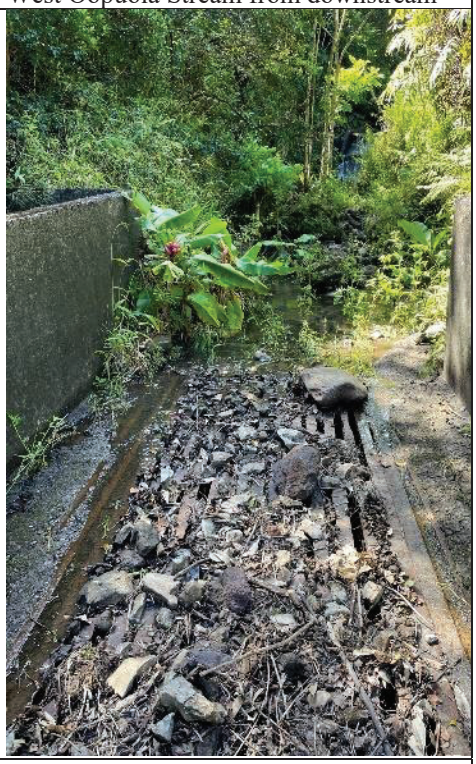
W-9 Wailoa Ditch intake on O‘opuola Stream	NH-6 Wailoa Ditch intake Oopuola Tributary	NH-7 New Hamakua Ditch intake on West Oopuola Stream from downstream
		
NH-6 New Hamakua Ditch intake on Oopuola Tributary	W-10 Wailoa Ditch intake on West Oopuola Stream	
		

Figure 13. Registered diversions in the O'opuola hydrologic unit, East Maui

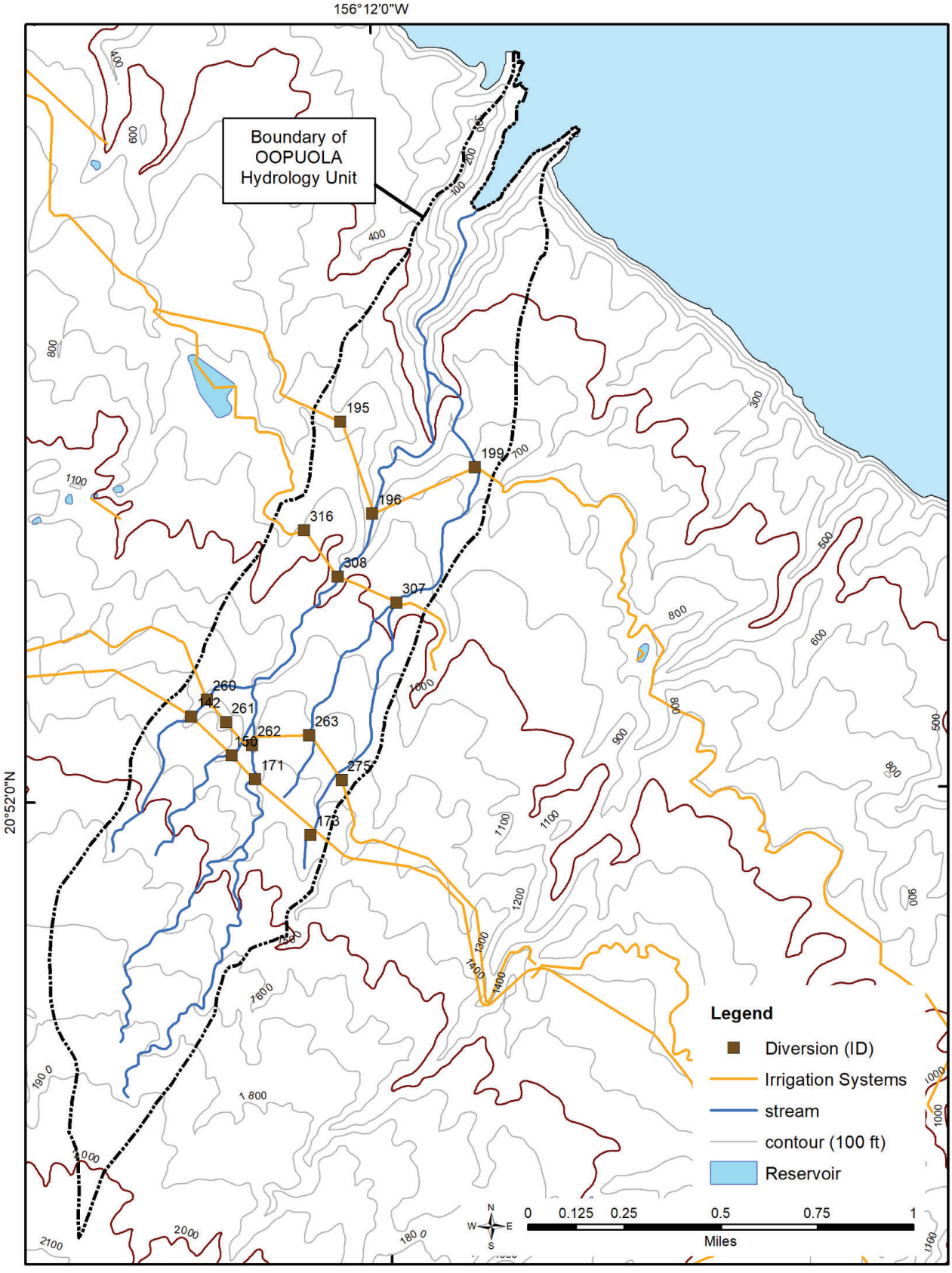


Figure 14. Seepage run results in the O'opuola hydrologic unit, East Maui

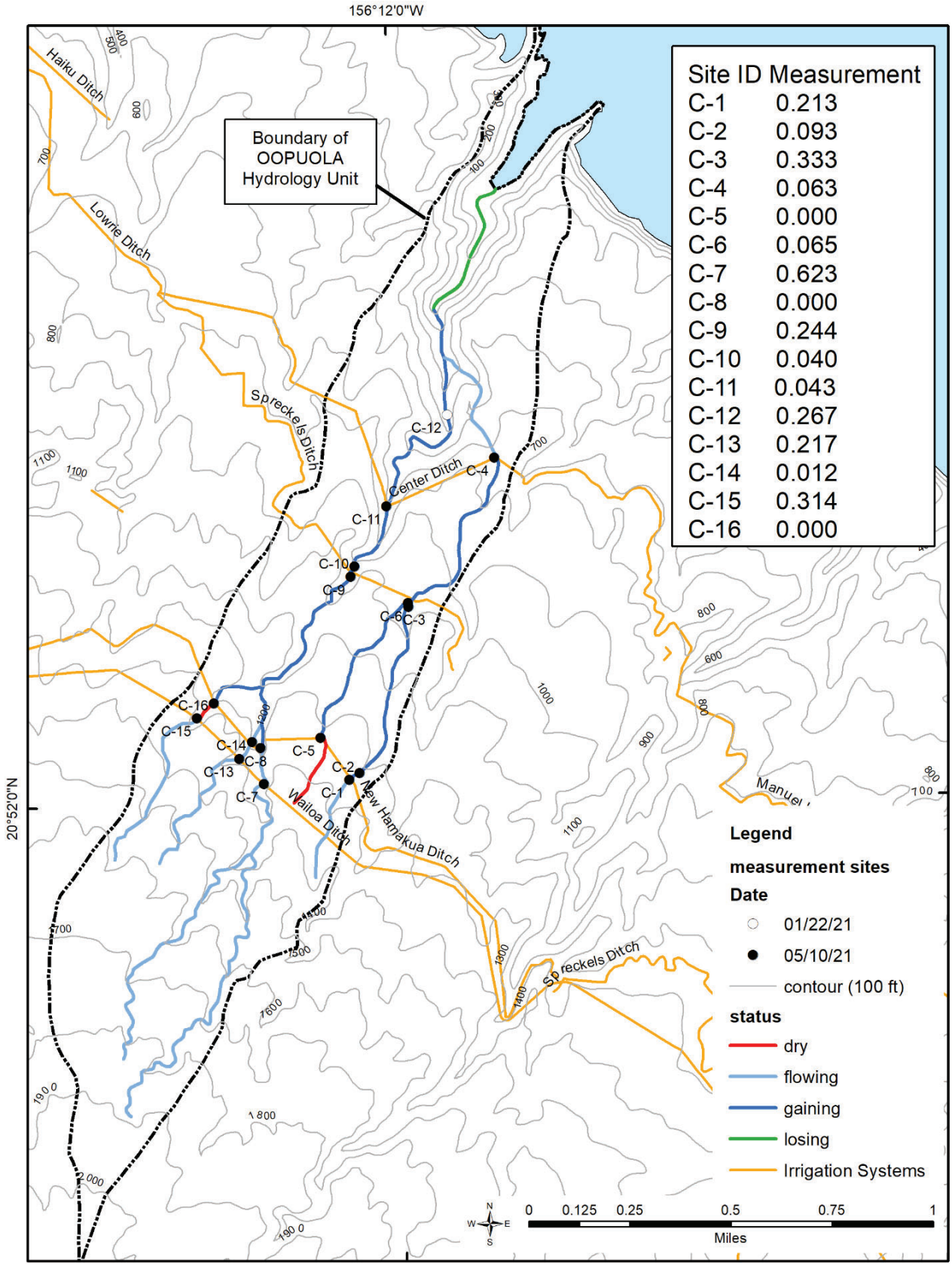
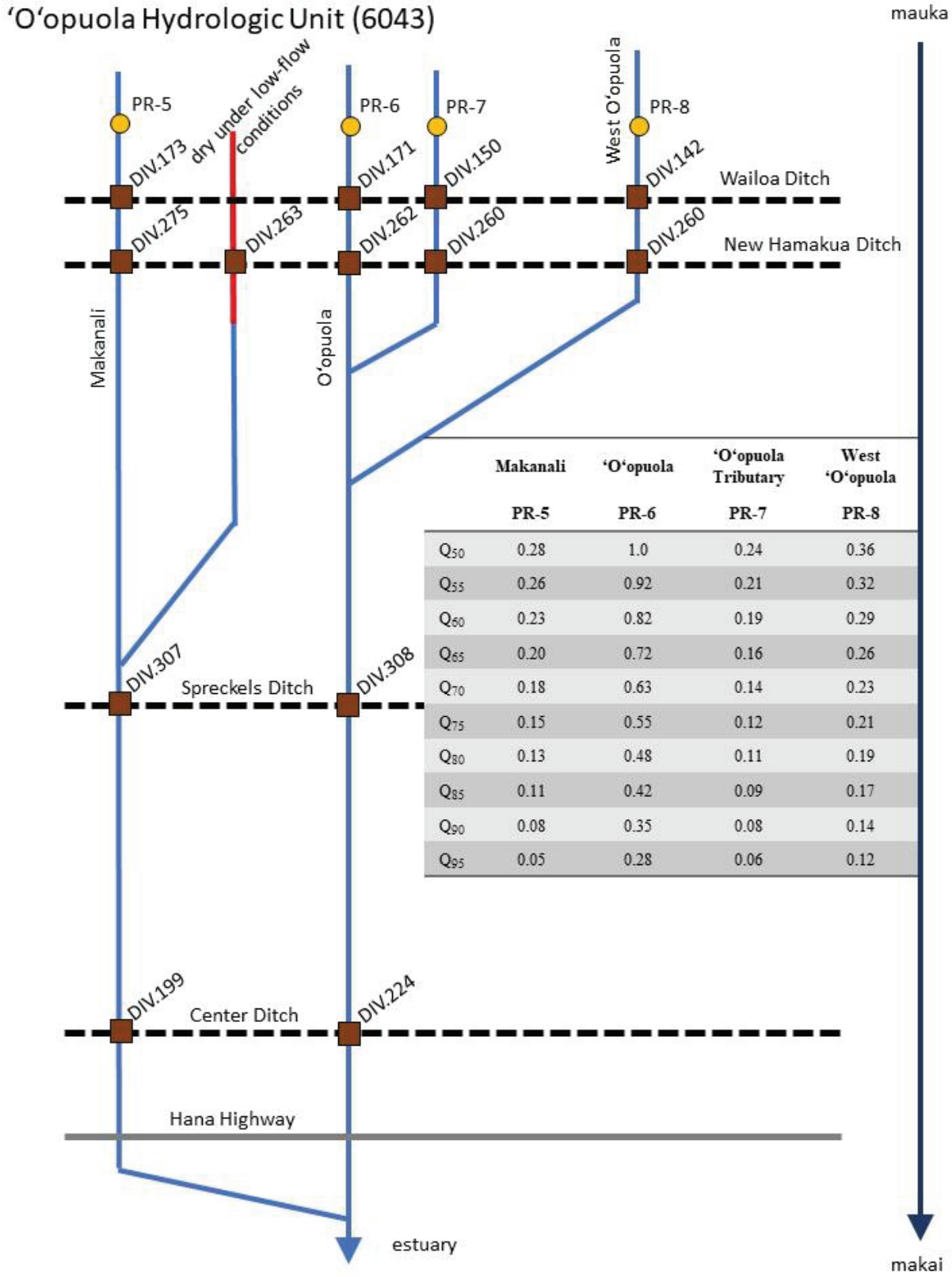


Figure 15. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions and the location of the partial-record (PR) gaging stations (flows in cubic feet per second) in the ʻOʻopuola hydrologic unit.



	Makanali	ʻOʻopuola	ʻOʻopuola Tributary	West ʻOʻopuola
	PR-5	PR-6	PR-7	PR-8
Q_{50}	0.28	1.0	0.24	0.36
Q_{55}	0.26	0.92	0.21	0.32
Q_{60}	0.23	0.82	0.19	0.29
Q_{65}	0.20	0.72	0.16	0.26
Q_{70}	0.18	0.63	0.14	0.23
Q_{75}	0.15	0.55	0.12	0.21
Q_{80}	0.13	0.48	0.11	0.19
Q_{85}	0.11	0.42	0.09	0.17
Q_{90}	0.08	0.35	0.08	0.14
Q_{95}	0.05	0.28	0.06	0.12

PUEHU (HYDROLOGIC UNIT: 6042)

Watershed Characteristics:
Area: 0.354 mi^2
Maximum elevation: 1680 ft
Land Use:
Total Stream Length: 2.94 mi
Terminal Order: 1

08/16/2021 11:00 Q = 0.088 cfs (0.057 mgd)
04/12/2021 16:24 Q = 0.077 cfs (0.050 mgd)

Biotic Information:
Terminal reach waterfall
No native species observed in 6 site visits

Historic Rankings:
Potential Heritage Stream: No
Hawaii Stream Assessment Rank: none
US Fish and Wildlife Service High Quality Stream: No
The Nature Conservancy Priority Aquatic Sites: No
National Park Service Nationwide Rivers Inventory: No

Watershed Rating:
Landcover: not ranked
Shallow Waters Rating: not ranked
Stewardship Rating: not ranked
Size Rating: not ranked
Wetness Rating: not ranked
Reach Diversity Rating: not ranked
Total Watershed Rating: not ranked

Biological Rating:
Native Species Rating: not ranked
Introduced Genera Rating: not ranked
All Species Score: not ranked
Total Biological Rating: not ranked

Overall Rating: not ranked
Rating Strength: not ranked

Hawaii Stream Assessment
HSA aquatic resources: not ranked
HSA riparian resources: not surveyed
HSA cultural resources: not surveyed
HSA recreational resources: not ranked

Registered Diversions
DIV 200 EAST MAUI IRR: C-9 Center Ditch from Pa Stream

Table 18. Stream diversions on Pa Stream at Center ditch, East Maui.

Measurement on Pa Stream above Center Ditch	C-9 Center Ditch at Pa Stream
	
Pa stream at mouth	
	

Figure 16. Registered diversions in the Puehu hydrologic unit, East Maui.

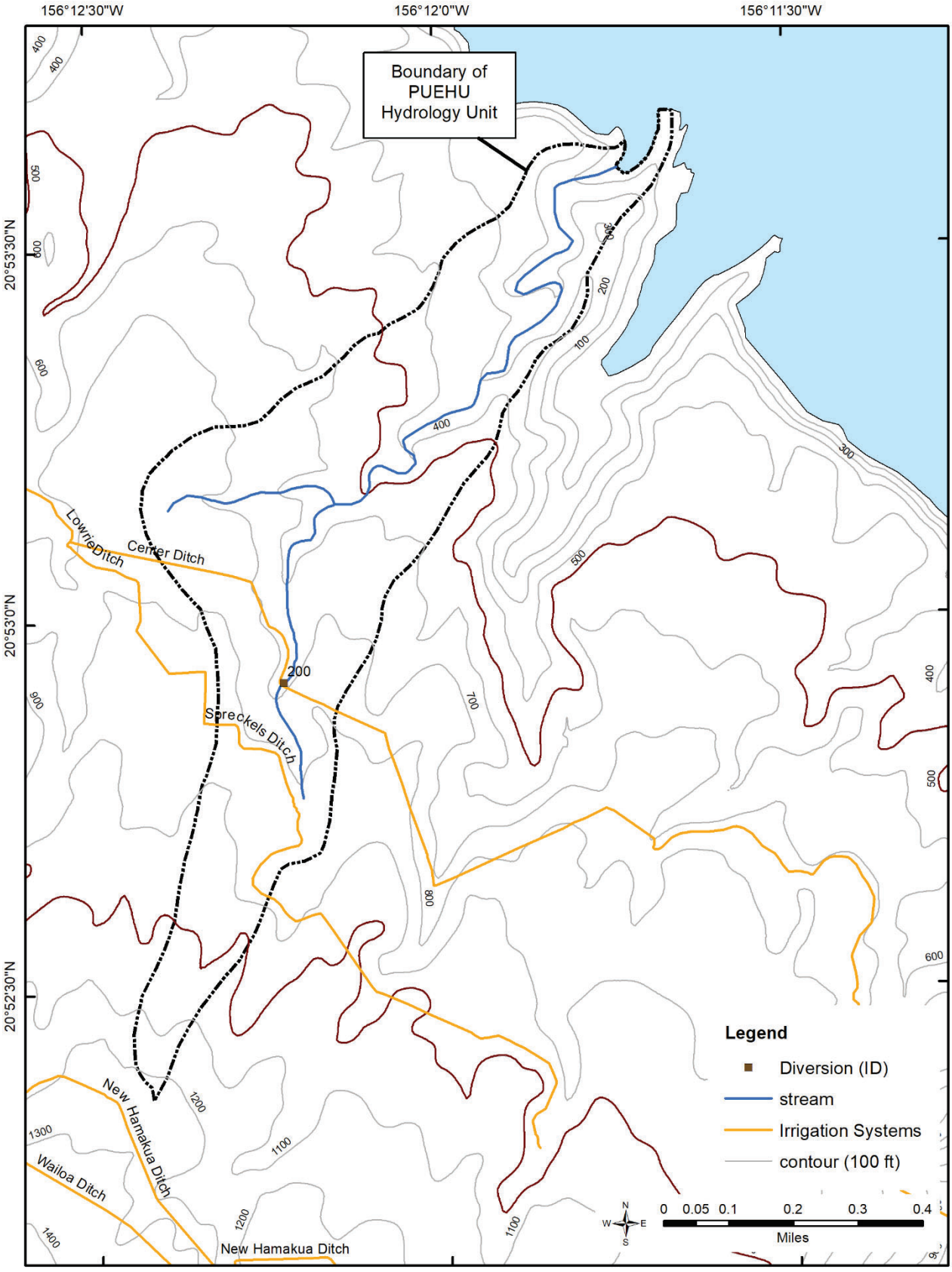
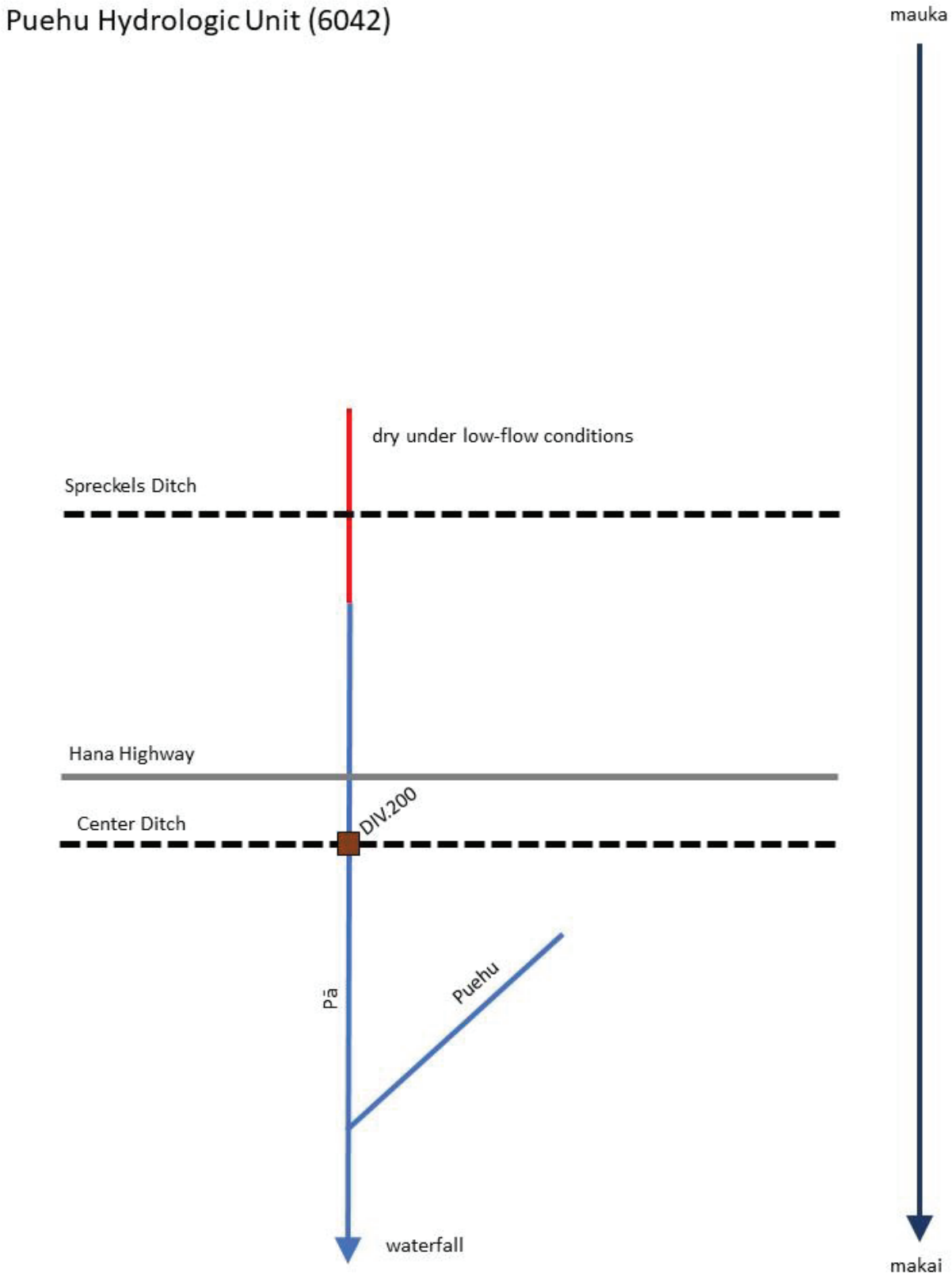


Figure 17. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions in the Puehu hydrologic unit, East Maui.



NAILIILIHAELE (HYDROLOGIC UNIT: 6041)

Watershed Characteristics:
Area: 3.53 mi^2
Maximum elevation: 5210 ft
Land Use: 8.2% agriculture; 91.8% conservation
Total Stream Length: 11.9 mi
Terminal Order: 3
Terminal Reach: multi-step waterfall with tidal plunge pool

Table 19. Low-flow characteristics from continuous-record gaging stations in the Nailiilihaʻele hydrologic unit.
[all values in cubic feet per second, cfs]

Station ID	site name	Period of Record	Q_{10}	Q_{20}	Q_{30}	Q_{40}	Q_{50}	Q_{60}	Q_{70}	Q_{80}	Q_{90}
16570000	Nailiilihaele Str nr Huelo	1911-1975	88	46	30	22	17	13	11	8.2	5.8
16570000	Nailiilihaele Str nr Huelo	1984-2013					14	12	8.6	7.0	4.6

Station ID	site name	Period of Record	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
CR-1	Nailiilihaele Str nr Huelo	1984-2013	13 (8.40)	11 (7.11)	9.9 (6.40)	8.5	7.3	6.2	5.3	4.5	3.7	2.8

Biotic Information:
Terminal reach waterfall
1961 DAR point quadrat survey
Atyoida bisulcata in middle and upper reaches
20 point-quadrant biota surveys conducted at 100ft near mouth (no native species), at 750ft above Lowrie Ditch (no native species), and at 1260ft above Wailoa Ditch (ʻōpae kalaʻole and ʻoʻopu alamoʻo observed) with flow restored past feeder ditch intake and Lowrie Ditch intake since 2016.

Historic Rankings:
Potential Heritage Stream: No
Hawaii Stream Assessment Rank: none
US Fish and Wildlife Service High Quality Stream: No
The Nature Conservancy Priority Aquatic Sites: No
National Park Service Nationwide Rivers Inventory: No

Watershed Rating:
Landcover: 10/10
Shallow Waters Rating: 0/10
Stewardship Rating: 6/10
Size Rating: 3/10
Wetness Rating: 8/10
Reach Diversity Rating: 5/10
Total Watershed Rating: 8/10

Biological Rating:
Native Species Rating: not ranked
Introduced Genera Rating: not ranked
All Species Score: 5/10
Total Biological Rating: 4/10

Overall Rating: 6/10
Rating Strength: 4/10

Hawaii Stream Assessment
HSA aquatic resources: ranked limited (1 low value native species observed); 2 surveys, last was in 1963
HSA riparian resources: detrimental plants (hau); detrimental animals (pigs); 20% native forest; palustrine wetland
HSA cultural resources: not surveyed
HSA recreational resources: swimming, scenic views; ranked a "3" by regional committee

Registered Diversions

DIV 180 EAST MAUI IRR: W-11 Wailoa Ditch from Nailiilihaele Stream
DIV 190 EAST MAUI IRR: W-12 Wailoa Ditch from Nailiilihaele Stream
DIV 167 EAST MAUI IRR: W-13 Wailoa Ditch from Nailiilihaele Stream
DIV 165 EAST MAUI IRR: Papaaea Reservoir on Nailiilihaele Stream
DIV 168 EAST MAUI IRR: W-14 Wailoa Ditch from Nailiilihaele Stream
DIV 272 EAST MAUI IRR: NH-9 New Hamakua from Ditch Nailiilihaele Stream
DIV 269 EAST MAUI IRR: NH-10 New Hamakua Ditch from Nailiilihaele Stream
DIV 268 EAST MAUI IRR: NH-11 New Hamakua Ditch from Nailiilihaele Stream
DIV 267 EAST MAUI IRR: NH-12 New Hamakua Ditch from Nailiilihaele Stream
DIV 255 EAST MAUI IRR: NH-13 New Hamakua Feeder Ditch to Papaaea Reservoir
DIV 306 EAST MAUI IRR: S-15 Spreckels Ditch from Nailiilihaele Stream
DIV 187 EAST MAUI IRR: L-1 Lowrie Ditch from Nailiilihaele Stream

Table 20. Stream diversions on Nailiilihaele Stream at Wailoa and New Hamakua ditches, East Maui.

W-14 Wailoa Ditch intake from Nailiihihaele	NH-12 New Hamakua Ditch dam from Nailiihihaele
	
W-14 Wailoa Ditch intake on Nailiihihaele from right bank	NH-12 New Hamakua Ditch dam from Nailiihihaele from right bank
	
W-13 Wailoa Ditch intake on Papaaea Tributary 3	W-13 Wailoa Ditch intake on Papaaea Tributary 3
	

Table 21. Stream diversions on Papaaea tributary at Wailoa Ditch and on Nailiilihaele Stream at Feeder ditche, East Maui.

W-12 Wailoa Ditch intake on Papaaea Tributary 2 from left bank	W-12 Wailoa Ditch intake on Papaaea Tributary 2 from right bank
	
W-11 Wailoa Ditch intake on Papaaea Tributary 1 from left bank	W-11 Wailoa Ditch intake on Papaaea Tributary 1 on right bank
	
NH-13 Feeder Ditch intake on Nailiilihaele Stream to Papaaea Reservoir from right bank	NH-13 Feeder Ditch intake on Nailiilihaele Stream to Papaaea Reservoir from left bank
	

Table 22. Lowrie Ditch and terminal reach plunge pool on Nailiilihaele and Kailua streams, East Maui.

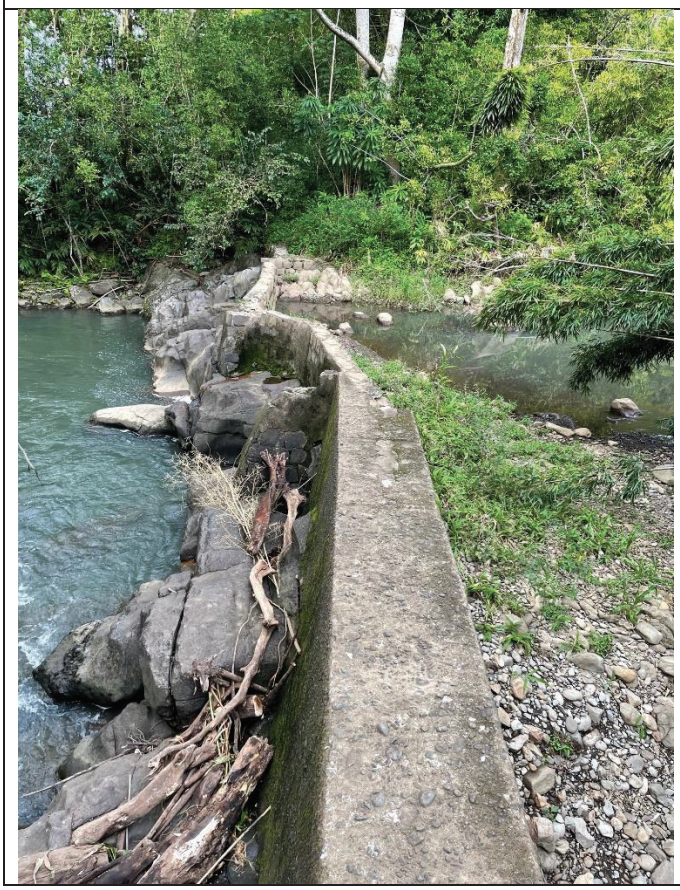
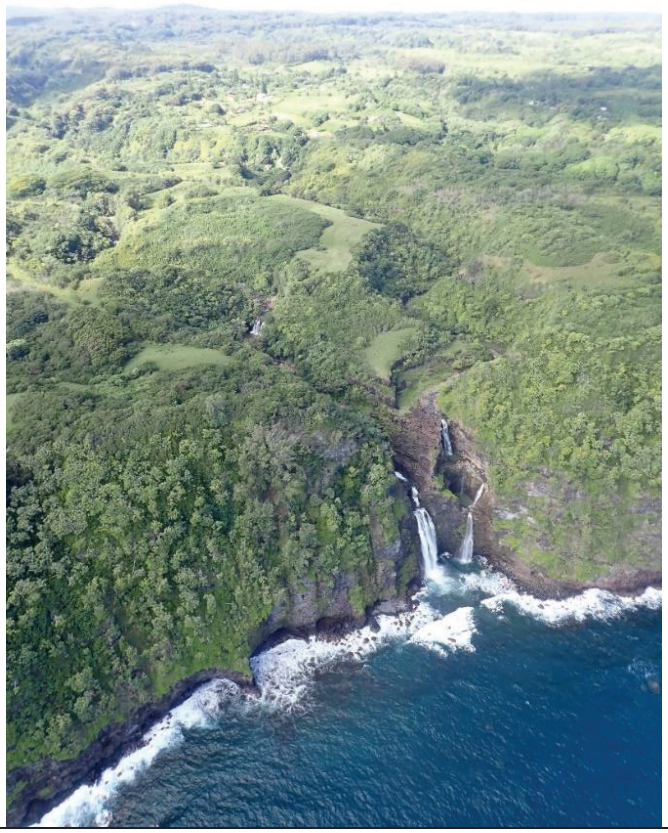
L-1 Lowrie Ditch at Nailiilihaele from downstream left bank	Terminal reach plunge pool on Nailiihihaele and Kailua streams
	
L-1 Lowrie Ditch at Nailiilihaele Stream from left bank	Terminal reach plunge pool on Nailiihihaele and Kailua streams
	

Figure 18. Registered stream diversions in the Nailiilihaele hydrologic unit, East Maui

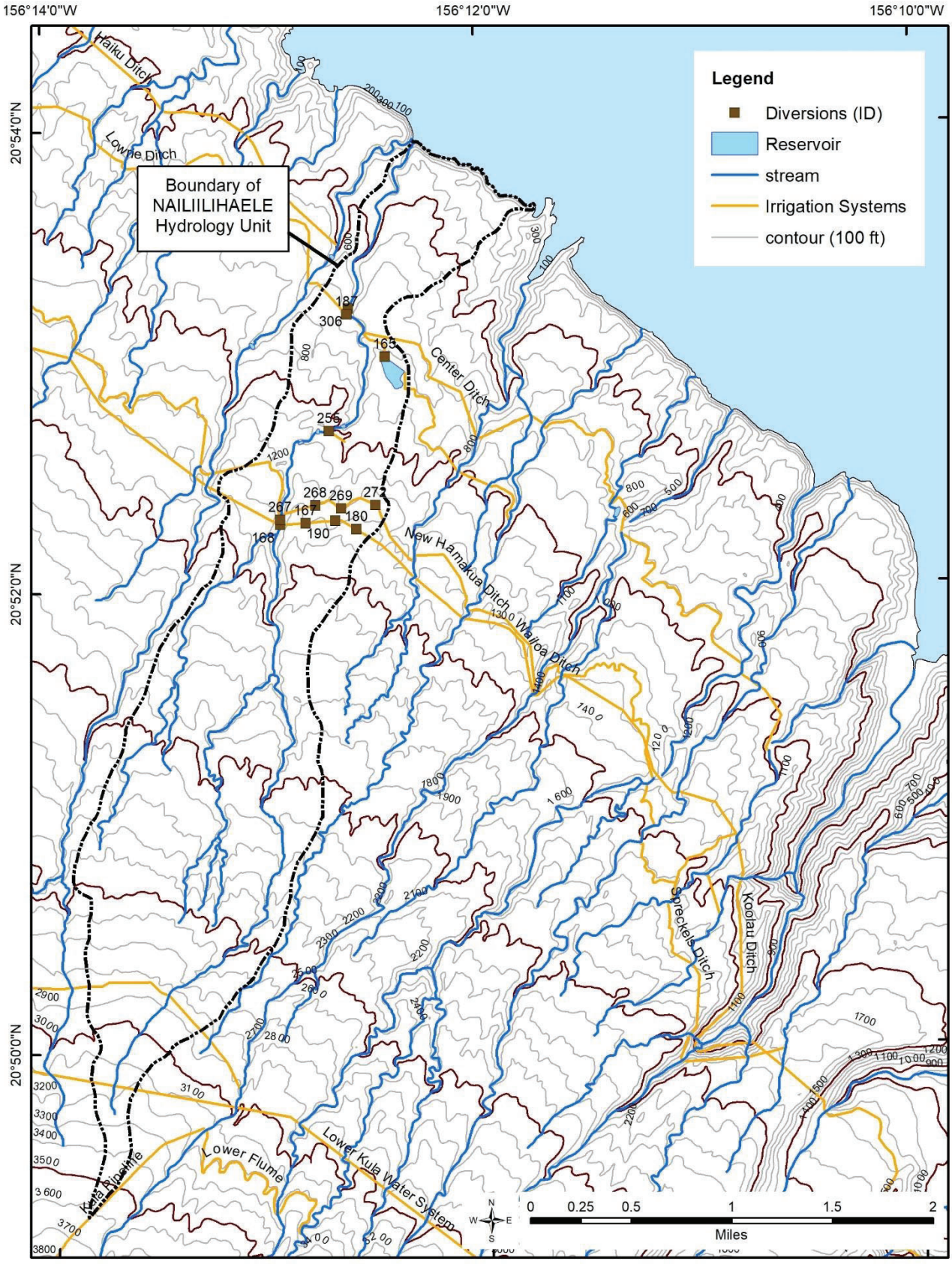


Figure 19. Seepage run results in Nailiilihaele hydrologic unit, East Maui

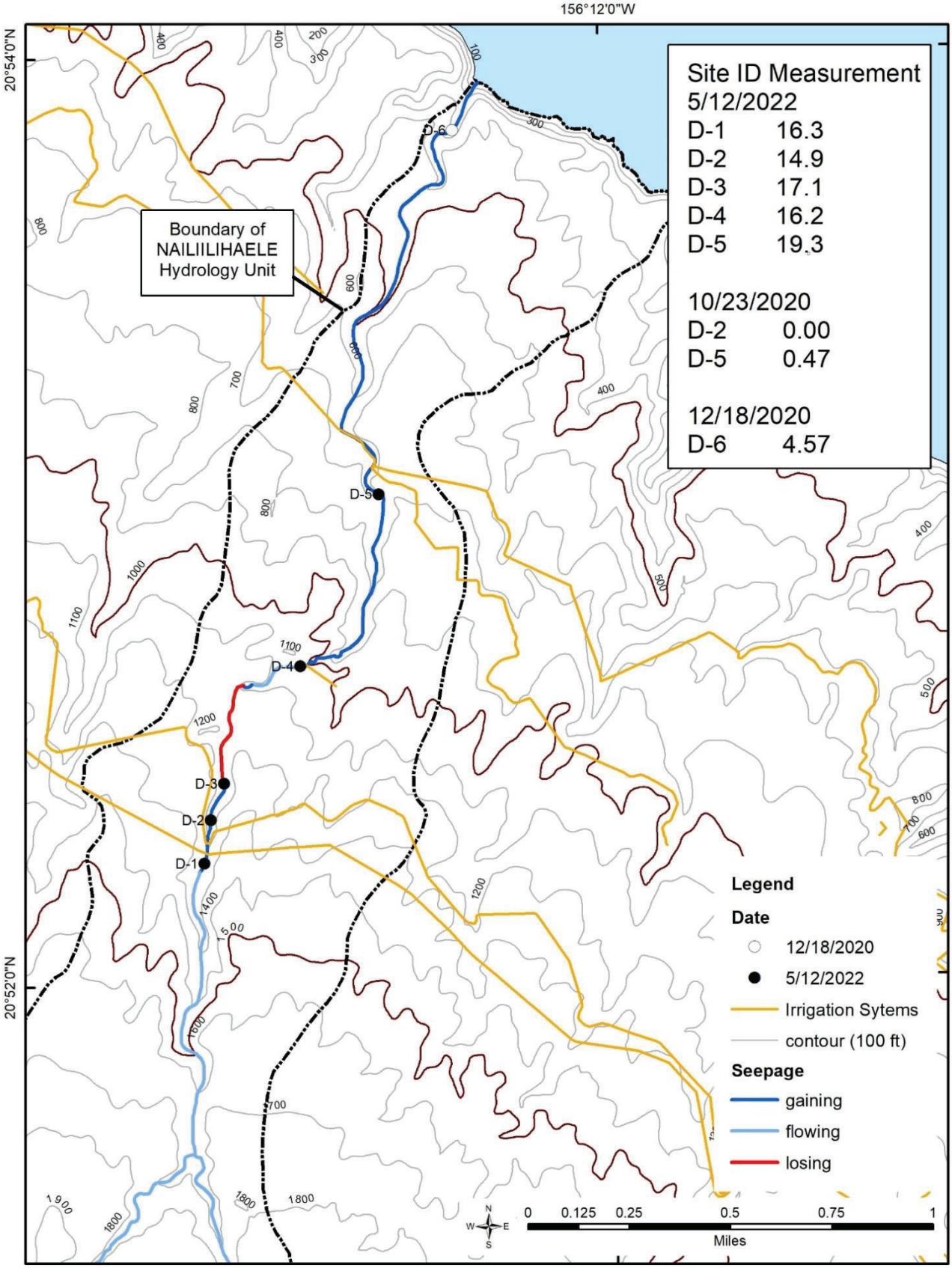
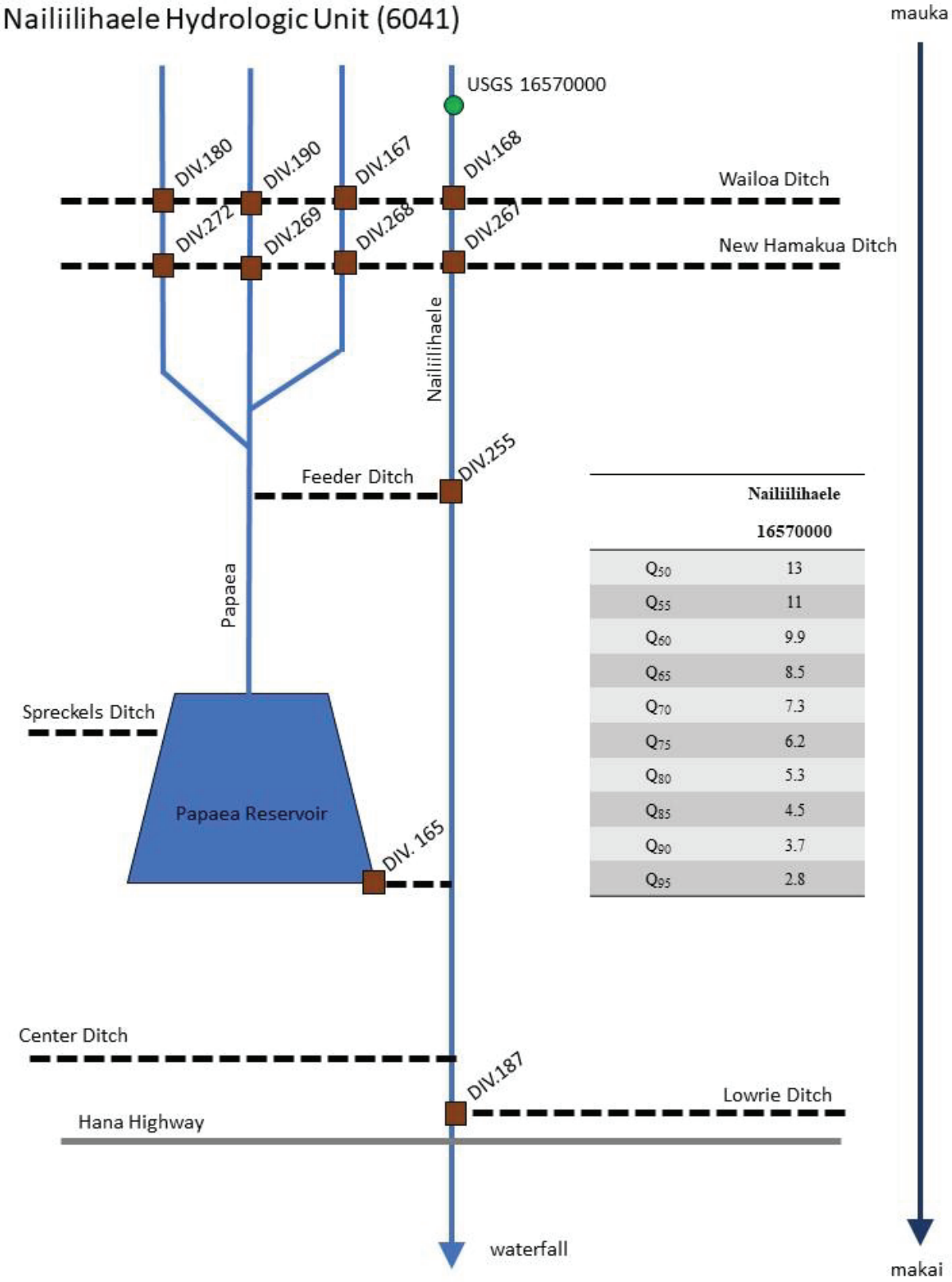


Figure 20. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions and the location of the partial-record (PR) gaging stations (in cubic feet per second) in the Nailiilihaele hydrologic unit.



	Nailiilihaele 16570000
Q_{50}	13
Q_{55}	11
Q_{60}	9.9
Q_{65}	8.5
Q_{70}	7.3
Q_{75}	6.2
Q_{80}	5.3
Q_{85}	4.5
Q_{90}	3.7
Q_{95}	2.8

KAILUA (HYDROLOGIC UNIT 6040)

Watershed Characteristics:
Area: 4.9 mi^2
Maximum elevation: 6549 ft
Land Use: 17.9% agriculture; 82.1% conservation
Total Stream Length: 10.7 mi
Terminal Order: 2
Terminal Reach: multi-step waterfall with tidal plunge pool

Table 23. Low-flow characteristics from continuous and partial-record (PR) gaging stations in the Kailua hydrologic unit.
[all values in cubic feet per second, cfs]

Station ID	name	Period of Record	Q_{10}	Q_{20}	Q_{30}	Q_{40}	Q_{50}	Q_{60}	Q_{70}	Q_{80}	Q_{90}
16577000	Kailua Str nr Huelo	1913-1958	68	45	19	13	9.4	7.3	5.4	3.9	2.6
16577000	Kailua Str nr Huelo	1984-2013					7.8	5.9	4.2	3.2	2.0

Station ID	site name	Period of Record	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
PR-9	Oanui Stream abv Wailoa Ditch	1984-2013	1.7 (1.10)	1.5 (0.97)	1.3 (0.84)	1.1 (0.71)	0.89 (0.58)	0.72 (0.47)	0.58 (0.37)	0.46 (0.30)	0.32 (0.21)	0.18 (0.12)
PR-10	Kailua Stream abv Lowrie Ditch	1984-2013	10 (6.45)	9.0 (5.82)	7.9 (5.11)	6.5 (4.20)	5.6 (3.62)	5.0 (3.23)	4.2 (2.71)	3.3 (2.13)	2.6 (1.68)	1.8 (1.16)

Biotic Information:
1961, 1962, 1988, 2003
Atyoida bisulcata in middle and upper reaches
Sicyopterus stimpsoni in upper reaches
20 point-quadrant biota surveys conducted at 100 ft above mouth (no native species) and at 750 ft above Lowrie Ditch (no native species)

Historic Rankings:
Potential Heritage Stream (1998): No
Hawaii Stream Assessment Rank (1990): moderate
US Fish and Wildlife High Quality Stream (1988): No
The Nature Conservancy Priority Aquatic Site (1985): No
National Park Service Nationwide Rivers Inventory (1982): No

Watershed Rating:
Landcover: 10/10
Shallow Waters Rating: 1/10
Stewardship Rating: 7/10
Size Rating: 2/10
Wetness Rating: 7/10
Reach Diversity Rating: 5/10
Total Watershed Rating: 7/10
Riparian issues: hau bush encroachment above mouth and above Lowrie ditch

Biological Rating:
Native Species Rating: 2/10
Introduced Genera Rating: 10/10
All Species Score: 5/10
Total Biological Rating: 5/10
Overall Rating: 7/10
Rating Strength: 6/10

Hawaii Stream Assessment
HSA aquatic resources: Moderate (1 high value species (nopili); 1 low value native species observed); 2 surveys, last was in 1963
HSA riparian resources: not ranked
HSA cultural resources: very limited survey coverage; 2 archeological sites; very few sites; pre-contact/early contact, important information; moderately sensitive; no taro historically associated with stream
HSA recreational resources: swimming; ranked a "2" by regional committee

Registered Diversions

DIV 185 EAST MAUI IRR: W-15 Wailoa Ditch from Kailua Stream
DIV 181 EAST MAUI IRR: W-16 Wailoa Ditch from Oanui Stream
DIV 273 EAST MAUI IRR: NH-14 New Hamakua Ditch from Oanui Stream
DIV 188 EAST MAUI IRR: L-2 Lowrie Ditch from Kailua Stream
DIV 250 EAST MAUI IRR: H-1 Haiku Ditch from Kailua Stream

Table 24. Stream diversions on Kailua and Oanui streams at Wailoa, New Hamakua, and Lowrie ditches, East Maui.

Upstream view of W-15 on Kailua Stream	W-15 intake grate on Kailua Stream from right bank
	
W-16 on Oanui Stream from right bank	Upstream view of NH-14 on Oanui Stream
	
L-2 intake on Kailua Stream from left bank	L-2 dam across Kailua Stream from left bank
	

Table 25. Stream diversions on Kailua Stream at Haiku ditch and the Kailua stream mouth, East Maui.

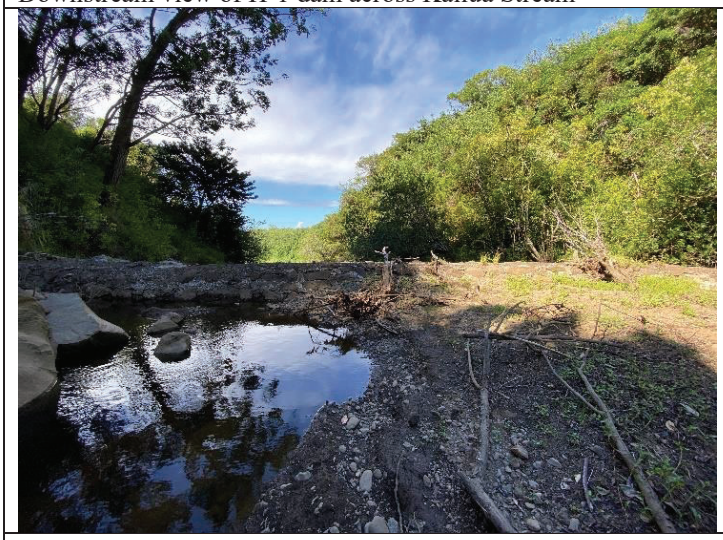
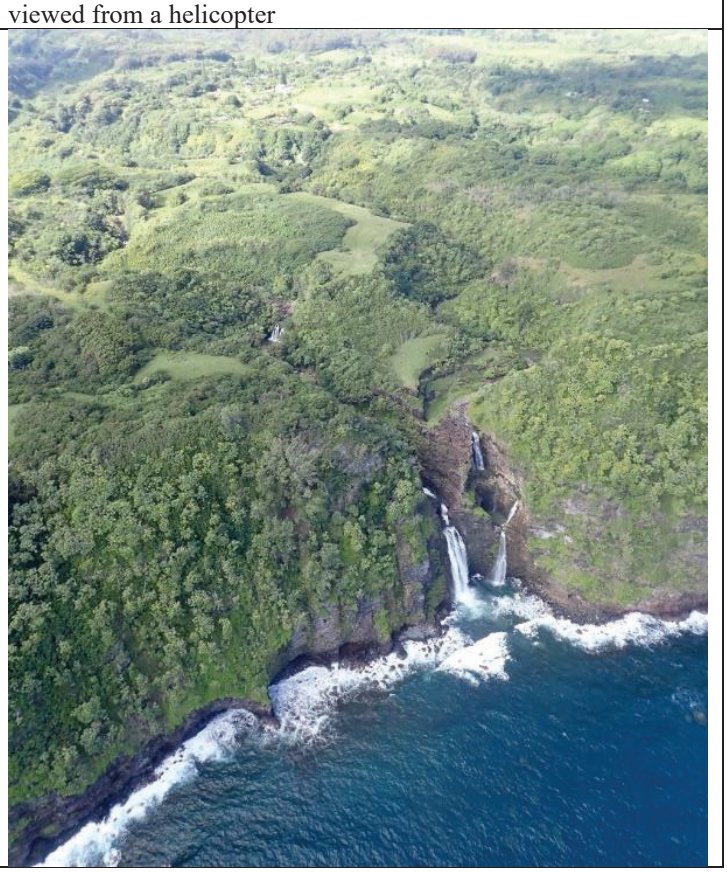
Downstream view of H-1 dam across Kailua Stream	H-1 dam across Kailua Stream from left bank
	
Nailiilihaele (left) and Kailua (right) streams terminal reach ends in a tidal plunge pool	Nailiilihaele (left) and Kailua (right) streams terminal reach as viewed from a helicopter
	

Figure 21. Registered stream diversions in the Kailua hydrologic unit, East Maui.

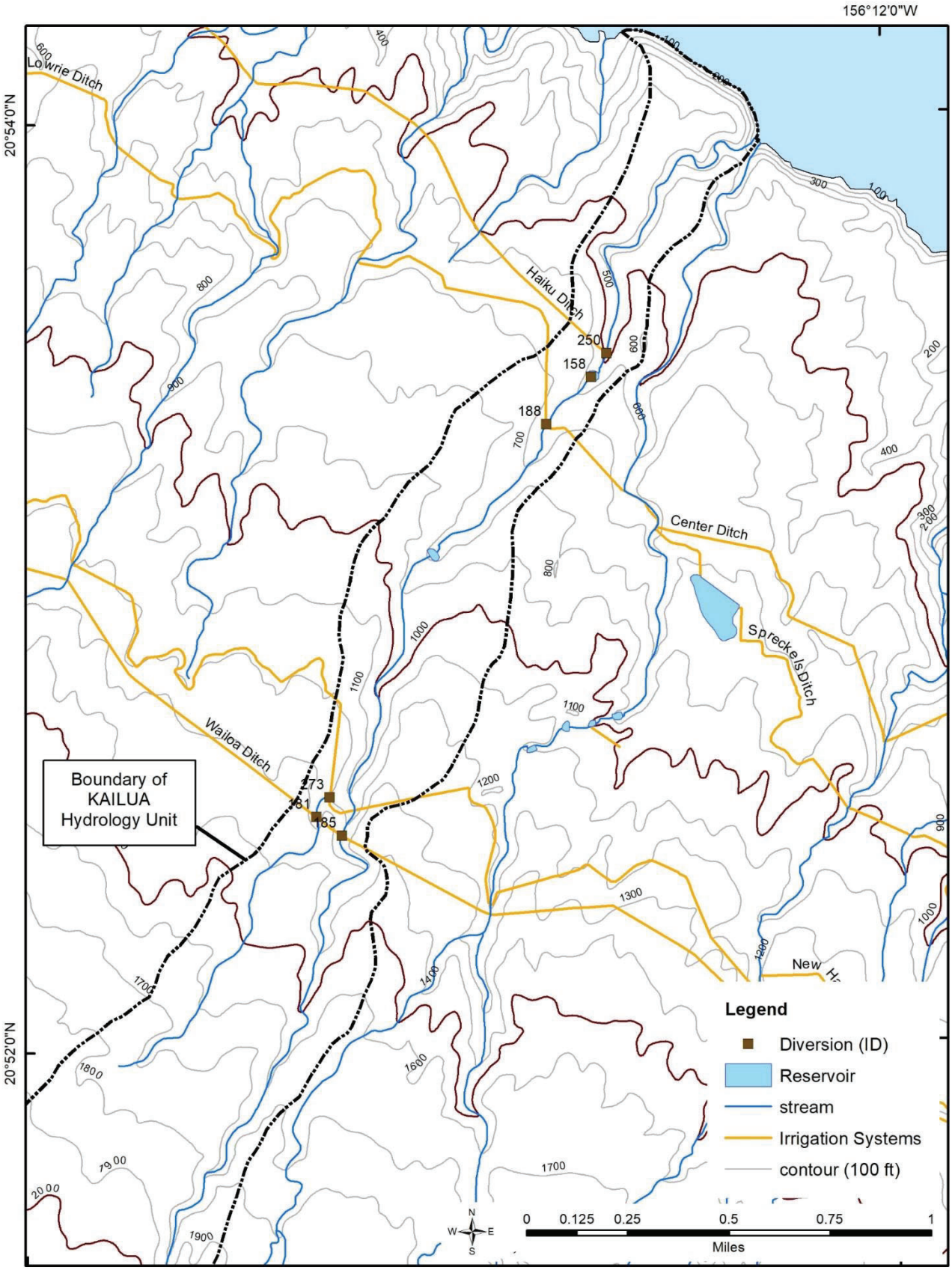


Figure 22. Seepage run results in the Kailua hydrologic unit, East Maui

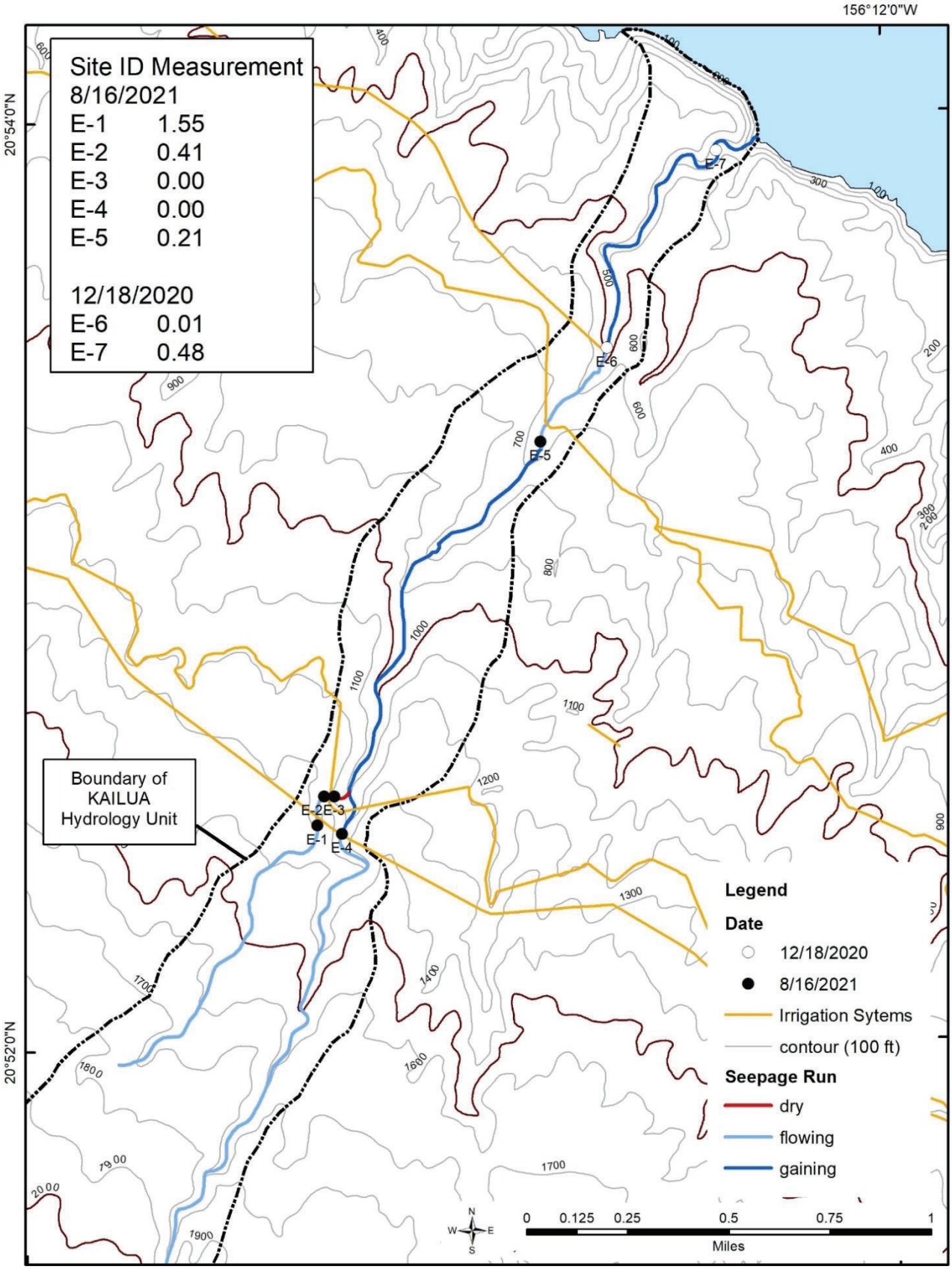
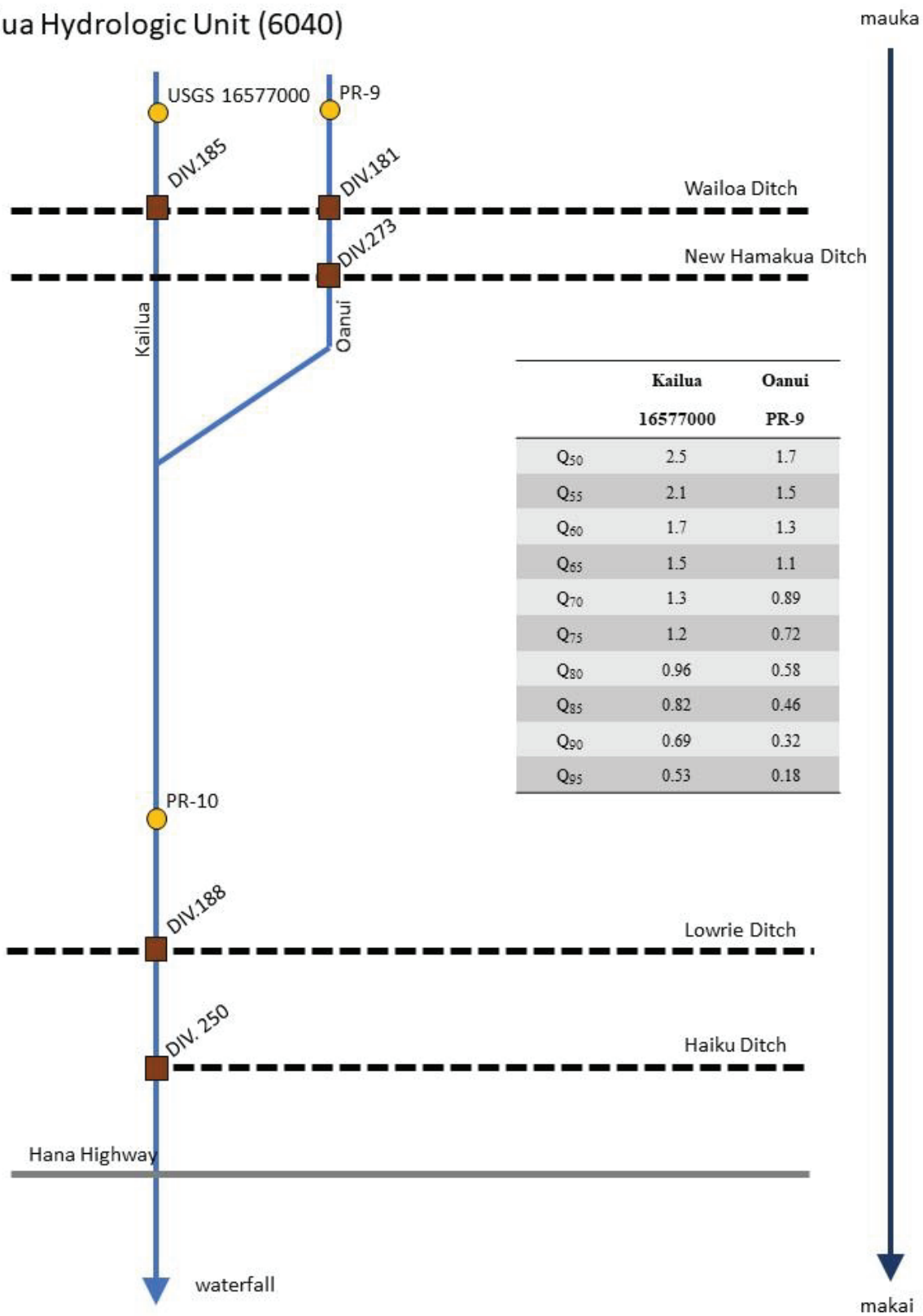


Figure 23. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions and the location of the partial-record (PR) gaging stations (flows in cubic feet per second) in the Kailua hydrologic unit.

Kailua Hydrologic Unit (6040)



	Kailua	Oanui
	16577000	PR-9
Q_{50}	2.5	1.7
Q_{55}	2.1	1.5
Q_{60}	1.7	1.3
Q_{65}	1.5	1.1
Q_{70}	1.3	0.89
Q_{75}	1.2	0.72
Q_{80}	0.96	0.58
Q_{85}	0.82	0.46
Q_{90}	0.69	0.32
Q_{95}	0.53	0.18

HĀNAWANA (HYDROLOGIC UNIT 6039)

Watershed Characteristics:
Area: 0.7 mi^2
Maximum elevation: 1535 ft
Land Use: 52.7% agriculture; 47.3% conservation
Total Stream Length: 0.8 mi
Terminal Order: 1

Table 26. Low-flow characteristics for natural flow from partial-record (PR) gaging stations in the Hānawana hydrologic unit.
[all values in cubic feet per second, cfs]

Station ID	site name	Period of Record	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
PR-11	Hānawana Stream abv Lowrie Ditch	1984-2013	0.44 (0.28)	0.39 (0.25)	0.34 (0.22)	0.27 (0.17)	0.25 (0.16)	0.21 (0.14)	0.17 (0.11)	0.14 (0.09)	0.12 (0.08)	0.09 (0.06)

Biotic Information:
Terminal reach waterfall
No native species observed in 19 site visits

Historic Rankings:
Potential Heritage Stream (1998): No
Hawaii Stream Assessment Rank (1990): not ranked
US Fish and Wildlife High Quality Stream (1988): No
The Nature Conservancy Priority Aquatic Site (1985): No
National Park Service Nationwide Rivers Inventory (1982): No

Watershed Rating:
Landcover: 9/10
Shallow Waters Rating: 0/10
Stewardship Rating: 3/10
Size Rating: 1/10
Wetness Rating: 5/10
Reach Diversity Rating: 1/10
Total Watershed Rating: 4/10

Biological Rating:
Native Species Rating: not ranked
Introduced Genera Rating: not ranked
All Species Score: not ranked
Total Biological Rating: not ranked

Overall Rating: not ranked
Rating Strength: 0/10

Hawaii Stream Assessment
HSA aquatic resources: not ranked
HSA riparian resources: not ranked
HSA cultural resources: not ranked
HSA recreational resources: hiking, swimming; ranked a "3" by regional committee

Registered Diversions

DIV 1211 WHITE J: 2 pipes from Hānawana Stream for two properties each for 120 gpm (approximately 0.27 cfs; 0.173 mgd) to irrigate 1.5 acres of banana and other fruit; one property was resold twice, new land owners are Callahans (in 2006) and the other is Captain Keith Douglas; in 2011 an easement was granted by BLNR for current landowners to utilize pipeline from stream across state lands to their property; the stream diversion works estimated elevation was 250 ft.
DIV 515 HOOPAI J: auwai/ditch from Hānawana Stream for 0.5 acre garden; not in use in 1993 field inspection or in 2020 field inspection
DIV 274 EAST MAUI IRR: NH-15 New Hamakua Ditch from Hānawana Stream
DIV 177 EAST MAUI IRR: L-3 Lowrie Ditch from Hānawana Stream
DIV 725 LOOMIS registered 25 gpm (0.056 cfs; 0.036 mgd) for 1 acre of vegetables, fruits, and flowers; not in use in 2020 field inspection

Existing Total Riparian Use: 0.535 cfs (0.346 mgd)

Table 27. Stream diversions and the stream mouth in the Hānawana hydrologic unit, East Maui.

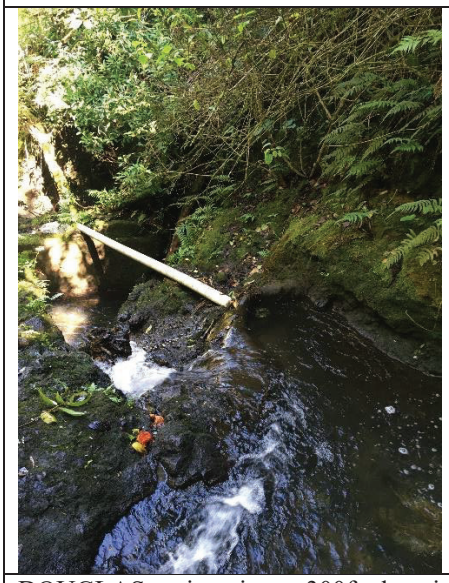
L-3 Lowrie Ditch at Hanawana Stream	4-inch bypass pipe across Lowrie Ditch for downstream users	Intake of 4-inch bypass pipe
		
DOUGLAS registration at 300ft elevation		DOUGLAS registration at 300ft elevation
		
WHITE registration at 310ft elevation		Hanawana Stream mouth
		

Figure 24. Registered diversions in the Hānawana hydrologic unit, East Maui

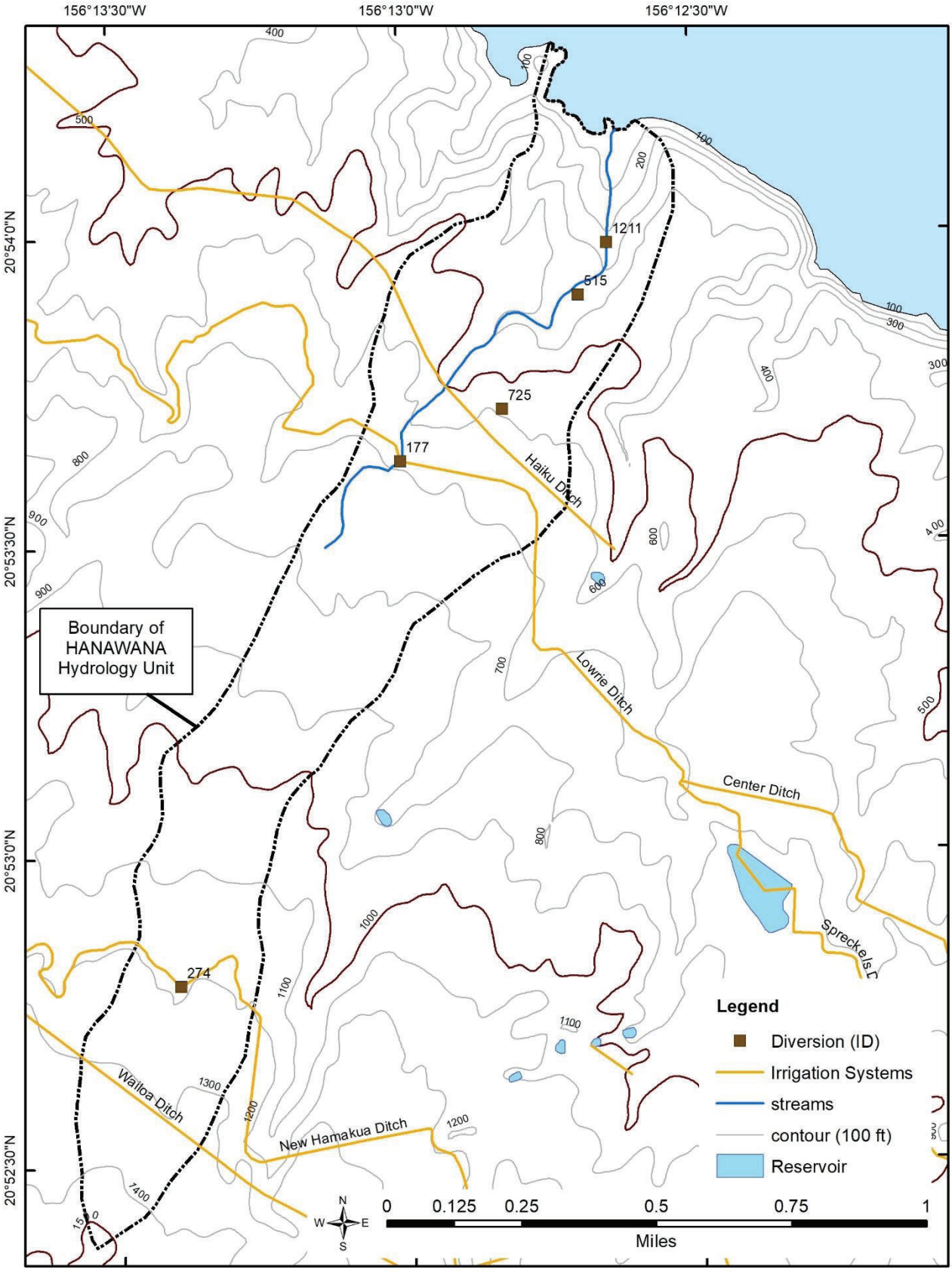
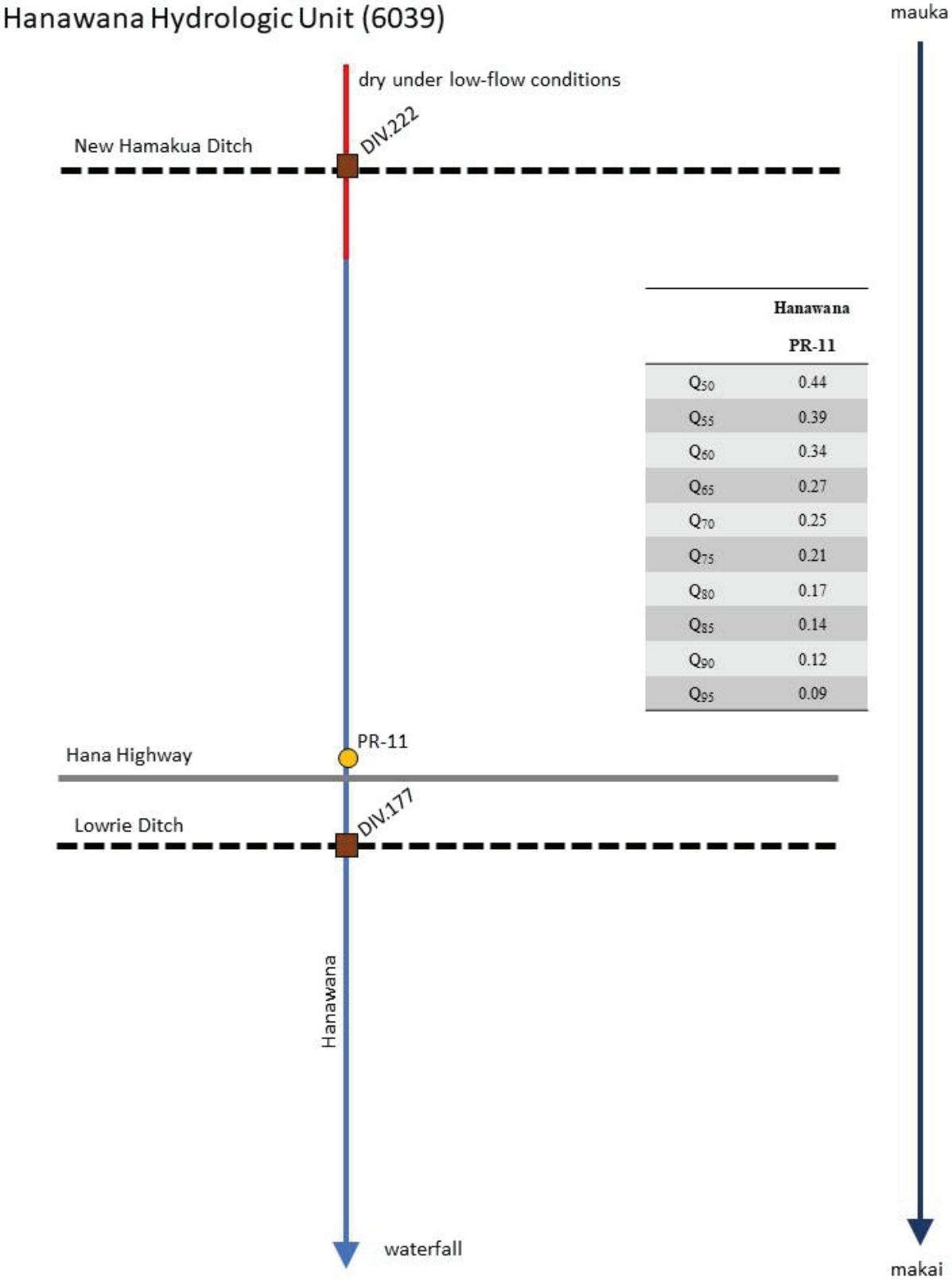


Figure 25. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions and the location of the partial-record (PR) gaging stations (flows in cubic feet per second) in the Hānawana hydrologic unit.



	Hanawana PR-11
Q_{50}	0.44
Q_{55}	0.39
Q_{60}	0.34
Q_{65}	0.27
Q_{70}	0.25
Q_{75}	0.21
Q_{80}	0.17
Q_{85}	0.14
Q_{90}	0.12
Q_{95}	0.09

HOALUA (HYDROLOGIC UNIT 6038)

Watershed Characteristics:
Area: 1.3 mi^2
Maximum elevation: 2887 ft
Land Use: 14.6% agriculture; 85.4% conservation
Total Stream Length: 2.4 mi
Terminal Order: 1

Table 28. Low-flow characteristics for natural flow from partial-record (PR) gaging stations in the Hoalua hydrologic unit.
[all values in cubic feet per second, cfs]

Station ID	site name	Period of Record	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
PR-12	Hoalua Stream abv Wailoa Ditch	1984-2013	1.3 (0.84)	1.1 (0.71)	1.0 (0.65)	0.94 (0.61)	0.85 (0.55)	0.76 (0.49)	0.68 (0.44)	0.61 (0.39)	0.53 (0.34)	0.44 (0.28)
PR-13	East Hoalua Stream abv Wailoa Ditch	1984-2013	1.1 (0.71)	0.98 (0.63)	0.87 (0.56)	0.76 (0.49)	0.67 (0.43)	0.58 (0.37)	0.51 (0.33)	0.44 (0.28)	0.37 (0.24)	0.29 (0.19)
PR-14	Hoalua Stream abv Lowrie Ditch	1984-2013	4.0 (2.59)	3.7 (2.39)	3.4 (2.19)	2.8 (1.81)	2.5 (1.62)	2.3 (1.48)	2.0 (1.29)	1.6 (1.03)	1.4 (0.90)	1.1 (0.71)

Biotic Information:
Terminal reach estuary
20 point-quadrant biota surveys (1 reach) conducted biota survey at 700 ft below Lowrie Ditch (no native species observed) with continual flow restored below New Hamakua Ditch, Lowrie Ditch, and Haikua Ditch since 2016.

Historic Rankings:
Potential Heritage Stream (1998): No
Hawaii Stream Assessment Rank (1990): not ranked
US Fish and Wildlife High Quality Stream (1988): No
The Nature Conservancy Priority Aquatic Site (1985): No
National Park Service Nationwide Rivers Inventory (1982): No

Watershed Rating:
Landcover: 10/10
Shallow Waters Rating: 0/10
Stewardship Rating: 6/10
Size Rating: 1/10
Wetness Rating: 7/10
Reach Diversity Rating: 3/10
Total Watershed Rating: 7/10

Riparian vegetation: hau bush encroachment at mouth and at 600-700 feet; bamboo encroachment at 300-450 feet

Biological Rating:
Native Species Rating: not ranked
Introduced Genera Rating: not ranked
All Species Score: not ranked
Total Biological Rating: not ranked
Overall Rating: not ranked
Ratiung Strength: 0/10

Hawaii Stream Assessment
HSA aquatic resources: not ranked
HSA riparian resources: detrimental animals (pigs); 0% native forest
HSA cultural resources: ranked outstanding; substantial information to assist prediction; 2 sites; low density; pre-contact or early contact sites with important information, and culturally noteworthy sites
HSA recreational resources: none; ranked a “4” by regional committee

Registered Diversions
DIV 186 EAST MAUI IRR: W-17 Wailoa Ditch from Hoalua Stream
DIV 245 EAST MAUI IRR: NH-16 New Hamakua Ditch from Hoalua Stream
DIV 141 EAST MAUI IRR: L-4 Lowrie Ditch from Hoalua Stream
DIV 230 EAST MAUI IRR: H-2 Haiku Ditch from Hoalua Stream

Table 29. Wailoa, New Hamakua, Lowrie, and Haiku ditch intakes and stream mouth on Hoalua Stream, East Maui.

Hoalua Stream above the Wailoa Ditch intake

W-17 Wailoa Ditch intake at Hoalua Stream from right bank

NH-16 New Hamakua Ditch intake at Hoalua Stream

L-4 Lowrie Ditch intake at Hoalua Stream

H-2 Haiku Ditch intake at Hoalua Stream

Hoalua Stream mouth

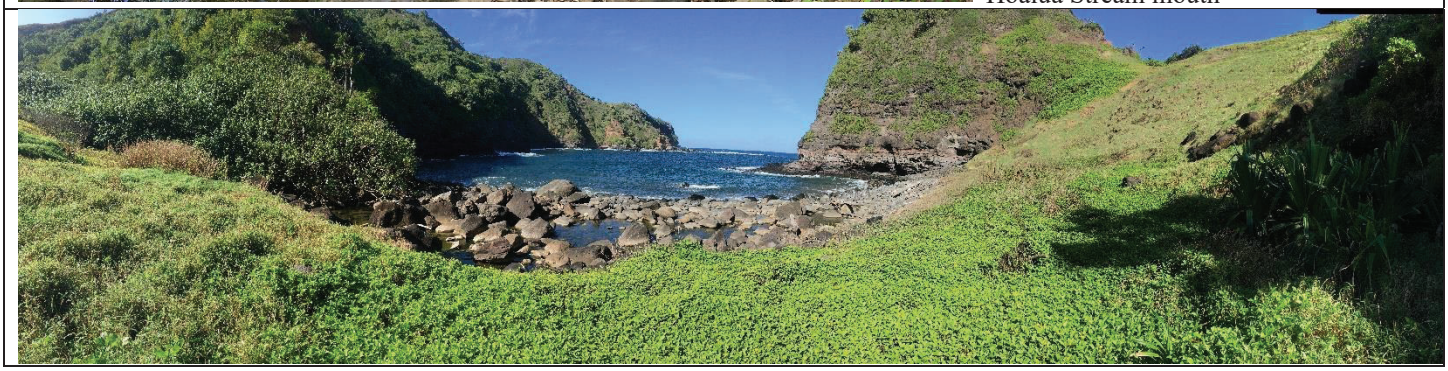


Figure 26. Registered diversions in the Hoalua hydrologic unit, East Maui

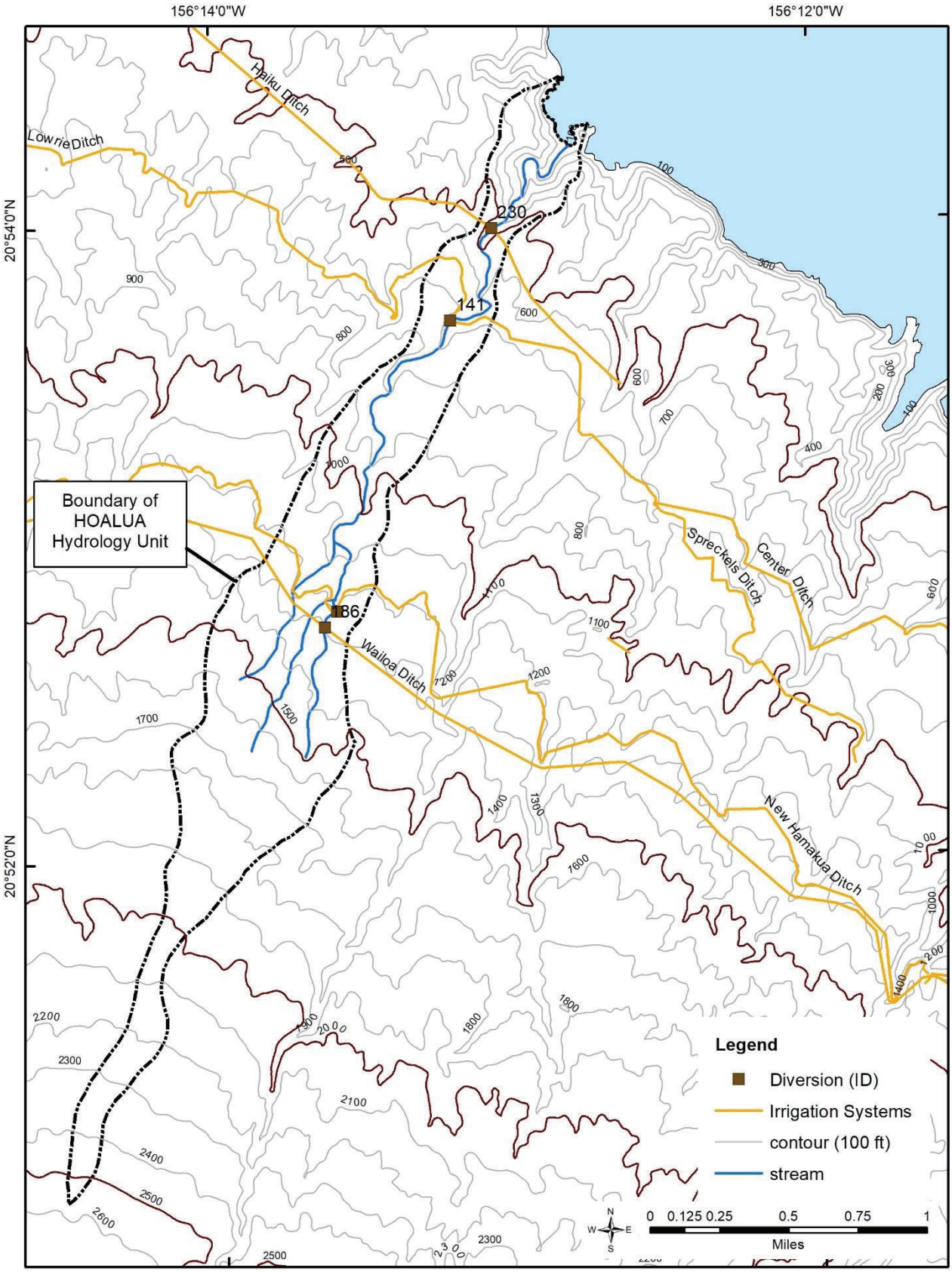


Figure 27. Seepage run results in the Hoalua hydrologic unit, East Maui

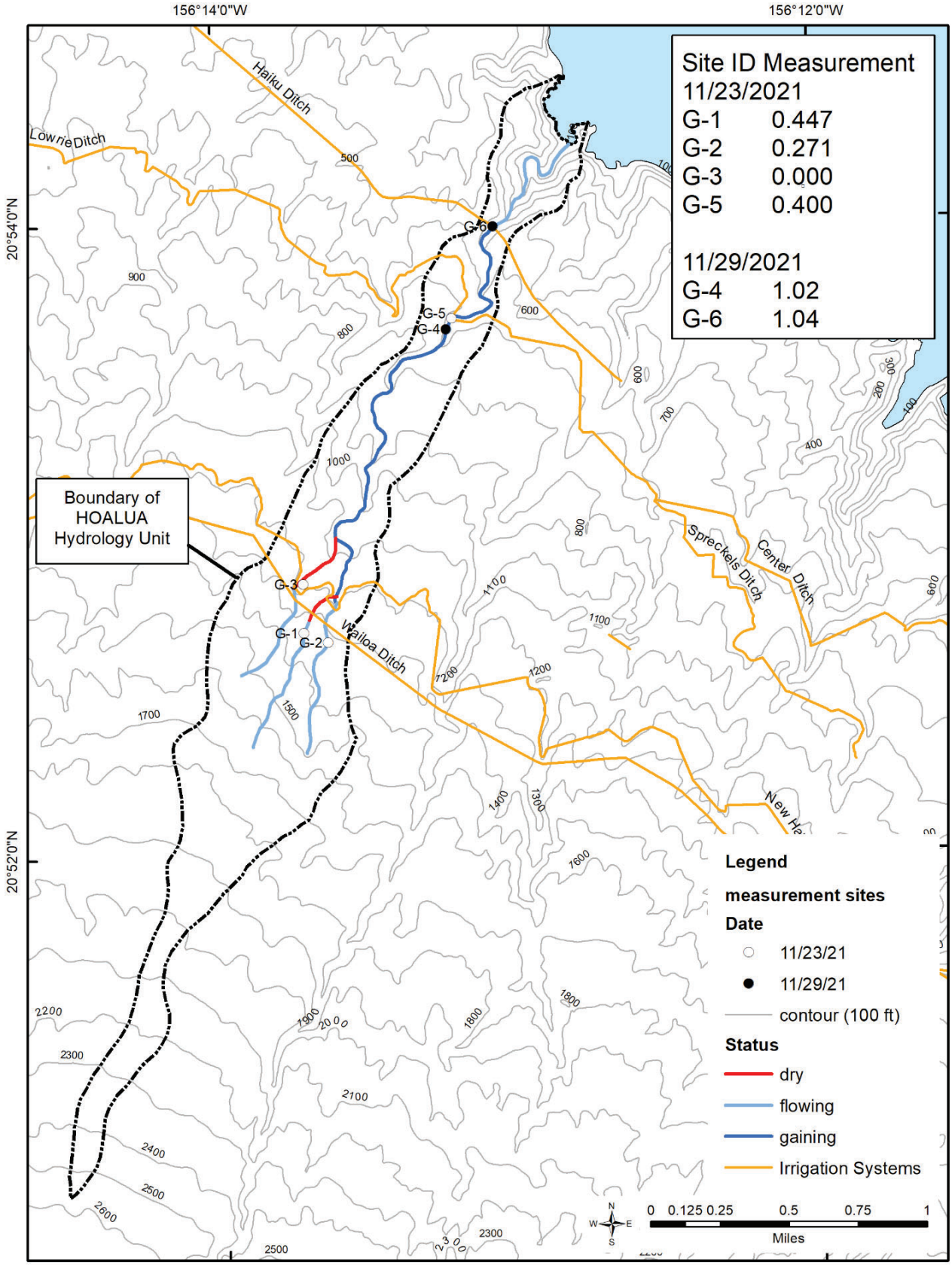
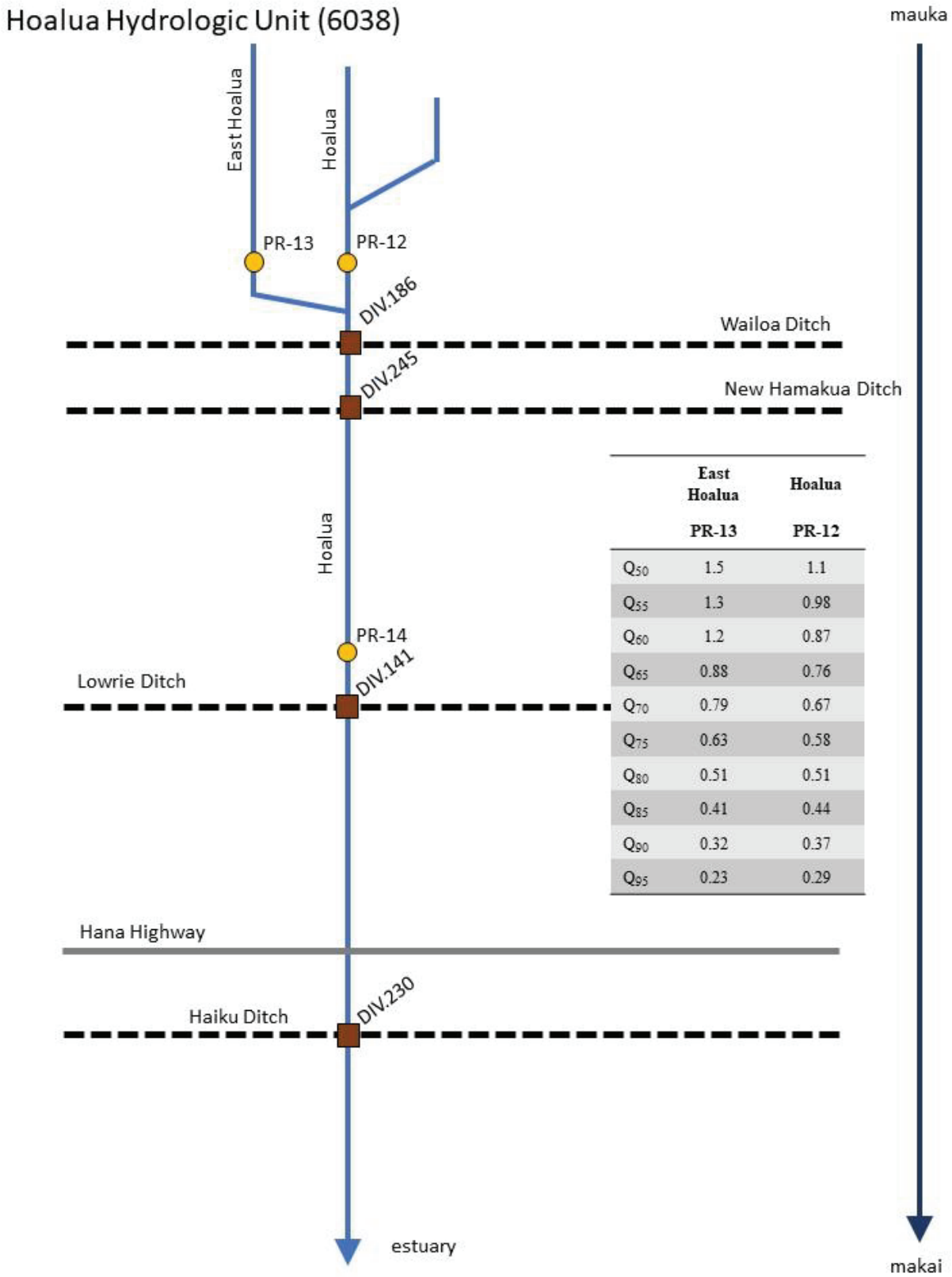


Figure 28. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions and the location of the partial-record (PR) gaging stations (flows in cubic feet per second) in the Hoalua hydrologic unit.



	East Hoalua	Hoalua
	PR-13	PR-12
Q_{50}	1.5	1.1
Q_{55}	1.3	0.98
Q_{60}	1.2	0.87
Q_{65}	0.88	0.76
Q_{70}	0.79	0.67
Q_{75}	0.63	0.58
Q_{80}	0.51	0.51
Q_{85}	0.41	0.44
Q_{90}	0.32	0.37
Q_{95}	0.23	0.29

WAIPI‘O (HYDROLOGIC UNIT: 6036)

Watershed Characteristics:
Area: 0.6 mi^2
Maximum elevation: 1529 ft
Land Use: 39.7% agriculture; 60.3% conservation
Total Stream Length: 2.8 mi
Terminal Order: 1

Table 30. Low-flow characteristics of natural flow from partial-record (PR) gaging stations in the Waipio hydrologic unit.
[all values in cubic feet per second, cfs (million gallons per day, mgd)]

Station ID	site name	Period of Record	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
PR-14	Waipi‘o Stream abv Wailoa Ditch	1984-2013	0.73 (0.47)	0.52 (0.34)	0.39 (0.25)	0.30 (0.19)	0.23 (0.15)	0.19 (0.12)	0.14 (0.09)	0.11 (0.07)	0.09 (0.06)	0.06 (0.04)

Biotic Information:
Terminal reach waterfall
No native species observed in 18 site visits

Historic Rankings:
Potential Heritage Stream (1998): No
Hawaii Stream Assessment Rank (1990): not ranked
US Fish and Wildlife High Quality Stream (1988): No
The Nature Conservancy Priority Aquatic Site (1985): No
National Park Service Nationwide Rivers Inventory (1982): No

Watershed Rating:
Landcover: 9/10
Shallow Waters Rating: 0/10
Stewardship Rating: 4/10
Size Rating: 1/10
Wetness Rating: 5/10
Reach Diversity Rating: 3/10
Total Watershed Rating: 5/10

Hau bush encroachment at 400ft and 700ft elevations.

Biological Rating:
Native Species Rating: not ranked
Introduced Genera Rating: not ranked
All Species Score: not ranked
Total Biological Rating: not ranked
Overall Rating: not ranked
Rating Strength: 0/10

Hawaii Stream Assessment
HSA aquatic resources: not ranked
HSA riparian resources: Detrimental plants (hau); Detrimental animals (pigs); 0% native forest; small palustrine wetland
HSA cultural resources: not surveyed

HSA recreational resources: none; ranked a "4" by regional committee

Registered Diversions
DIV 201 EMI: NH-18 New Hamakua Ditch from Waipio Stream
DIV 1124 VALLEY FARM: diversion of 0.309 cfs (0.20 mgd) from Waipi'o Stream at approximately 800 ft elevation to auwai to irrigation 2.79 acres of flows, fruit, vegetables, taro
DIV 1125 VALLEY FARM: pump 7,500 gallons per day from Waipio Stream to supplement auwai
DIV 238 EMI: L-5 Lowrie Ditch from Waipio Stream
DIV 1104 TROPICAL ORCH: pump 4,000 gallons per day from Waipio Stream for 1 acre of orchids and 3 acres of ornamentals
DIV 216 EMI: Haiku Ditch from Waipio Stream
DIV 1207 WENTWORTH R: 1 inch pipe from Waipio Stream for 0.25 acre of landscaping (~600 gallons per day)
DIV 66 BUNCH WJ: diversion from Waipio Stream to irrigate 4 acres of landscaping and citrus trees (~8000 gallons per day)
DIV 448 HAROLD FL: pump from Waipio Stream to irrigation 20.25 acres of fruit trees, vegetables, and livestock; following 2005 investigation, registrant actually takes water via 1inch pipeline from EMI ditch

Existing Total Riparian Use: 0.34 cfs (0.220 mgd)

Table 31. Registered stream diversions in the Waipi'o hydrologic unit, East Maui.

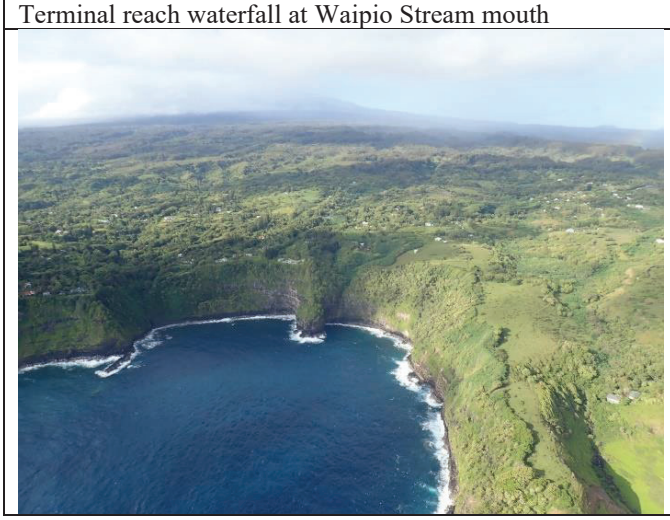
Upstream view of Waipio Stream abv New Hamakua Ditch	NH-18 New Hamakua Ditch intake at Waipio Stream
	
L-5 Waipio Stream at 700ft elevation	Pump from Waipio stream registered to TROPICAL ORCH
	
Terminal reach waterfall at Waipio Stream mouth	H-6 Haiku Ditch at Waipio Stream
	

Figure 29. Registered stream diversions in the Waipi'o hydrologic unit, East Maui

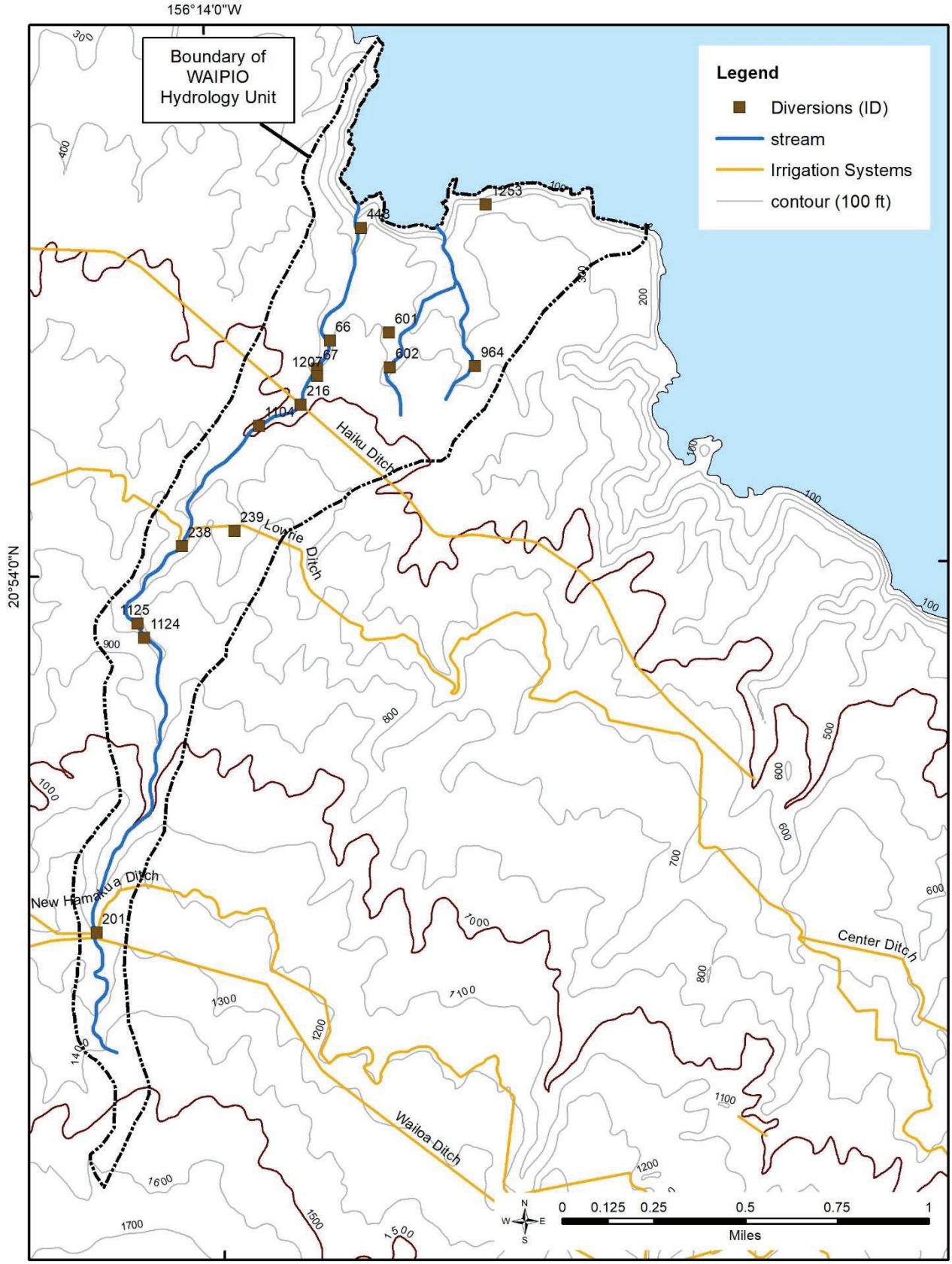


Figure 30. Seepage run results in the Waipi'o hydrologic unit, East Maui

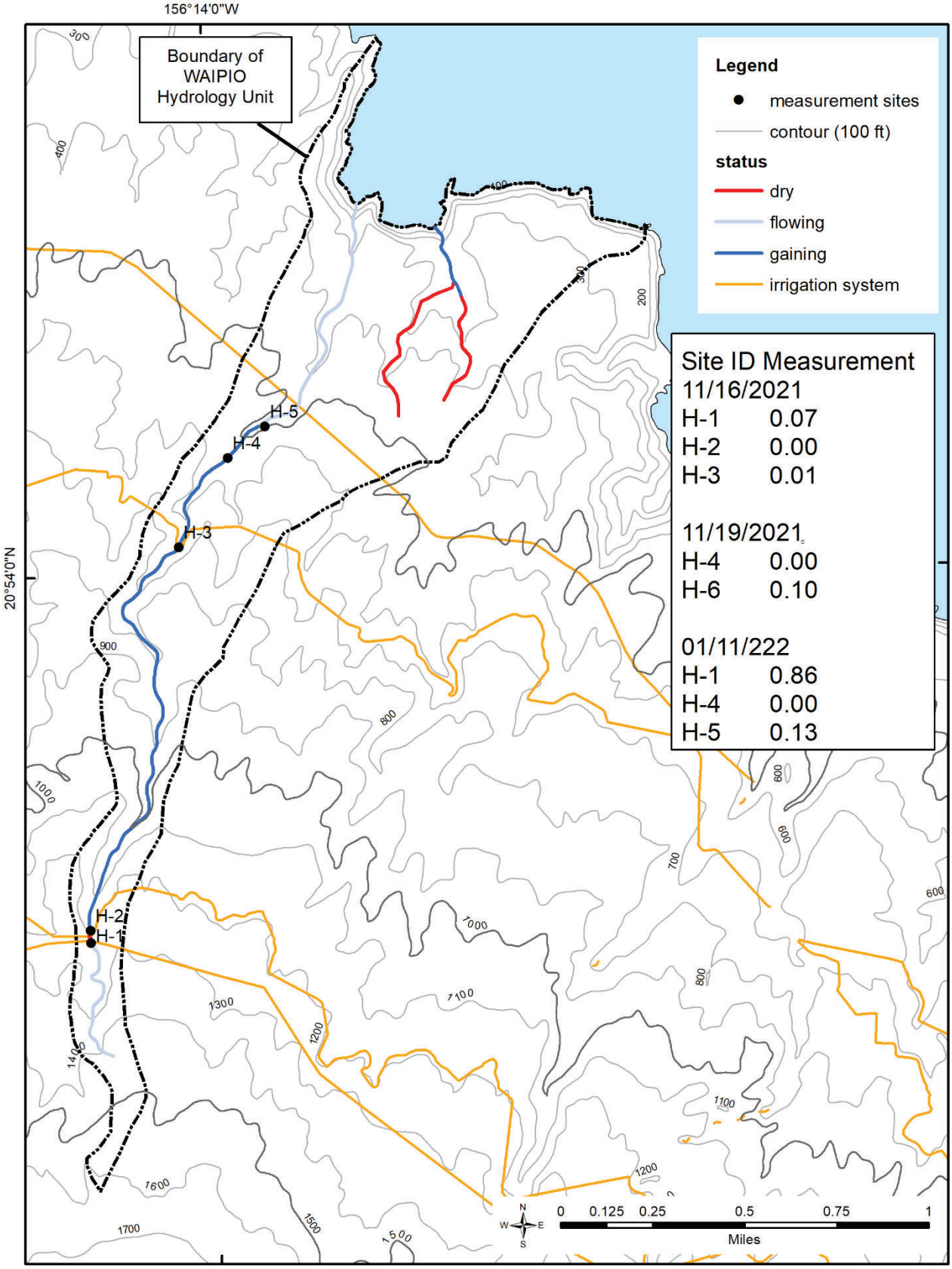
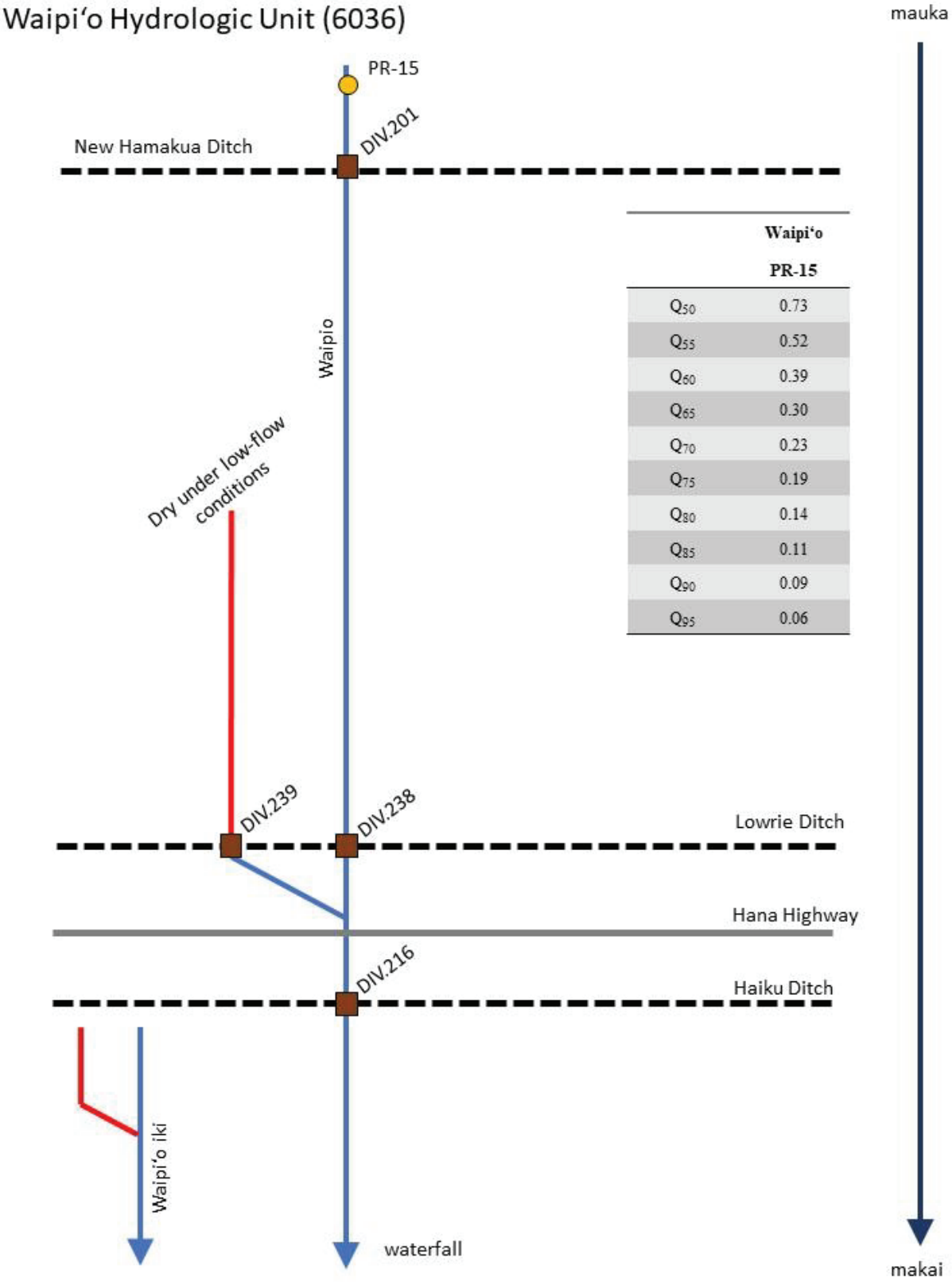


Figure 31. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions and the location of the partial-record (PR) gaging stations (flows in cubic feet per second) in the Waipi‘o hydrologic unit.



	Waipi‘o PR-15
Q_{50}	0.73
Q_{55}	0.52
Q_{60}	0.39
Q_{65}	0.30
Q_{70}	0.23
Q_{75}	0.19
Q_{80}	0.14
Q_{85}	0.11
Q_{90}	0.09
Q_{95}	0.06

HO‘OLAWA (HYDROLOGIC UNIT 6035)

Watershed Characteristics:
Area: 3.6 mi^2
Maximum elevation: 3481 ft
Land Use: 14.6% agriculture; 85.4% conservation
Total Stream Length: 11.0 mi
Terminal Order: 2

Table 32. Low-flow characteristics for natural flow from continuous and partial-record (PR) gaging stations in the Hoolawa hydrologic unit. [all values in cubic feet per second, cfs (million gallons per day, mgd)]

Station ID	site name	Period of Record	Q_{10}	Q_{20}	Q_{30}	Q_{40}	Q_{50}	Q_{60}	Q_{70}	Q_{80}	Q_{90}
16585000	Hoolawanui Str nr Huelo	1911-1971	26	19	9.8	7.4	5.6	4.3	3.3	2.5	1.7
16585000	Hoolawanui Str nr Huelo	1984-2013					4.4	3.5	2.6	1.9	1.4
16586000	Hoolawaliilii Str nr Huelo	1912-1957	14	10	6.5	5.3	4.4	3.7	3.2	2.8	2.2
16586000	Hoolawaliilii Str nr Huelo	1984-2013					3.6	3.1	2.7	2.2	1.7

Station ID	site name	Period of Record	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
PR-15	Hoolawaliilii Stream abv Wailoa Ditch	1984-2013	3.3 (2.13)	3.1 (2.00)	2.8 (1.81)	2.5 (1.62)	2.3 (1.49)	2.1 (1.36)	1.9 (1.23)	1.7 (1.10)	1.5 (0.97)	1.2 (0.78)
PR-16	Hoolawanui Stream abv Wailoa Ditch	1984-2013	3.0 (1.94)	2.7 (1.75)	2.4 (1.55)	2.0 (1.29)	1.8 (1.16)	1.5 (0.97)	1.3 (0.84)	1.1 (0.71)	0.91 (0.59)	0.71 (0.46)
PR-17	West Hoolawanui Stream abv Wailoa Ditch	1984-2013	0.26 (0.17)	0.23 (0.15)	0.21 (0.14)	0.17 (0.11)	0.16 (0.10)	0.13 (0.08)	0.12 (0.08)	0.10 (0.65)	0.08 (0.05)	0.07 (0.04)
PR-18	Hoolawaliilii Stream abv Lowrie Ditch	1984-2013	4.4 (2.84)	4.1 (2.65)	3.8 (2.46)	3.3 (2.13)	3.2 (2.07)	2.8 (1.81)	2.5 (1.62)	2.2 (1.42)	2.0 (1.29)	1.7 (1.10)
PR-19	Hoolawanui Stream abv Lowrie Ditch	1984-2013	3.9 (2.52)	3.5 (2.26)	3.1 (2.00)	2.6 (1.68)	2.4 (1.55)	2.0 (1.29)	1.7 (1.10)	1.5 (0.97)	1.3 (0.84)	1.0 (0.65)
	Ho‘olawa at Haiku Ditch	1984-2013	8.5 (5.49)	7.8 (5.04)	7.1 (4.59)	6.1 (3.90)	5.8 (3.74)	5.0 (3.23)	4.4 (2.84)	3.9 (2.52)	3.3 (2.13)	2.7 (1.74)
PR-20	Mokupapa Stream abv Haiku Ditch	1984-2013	<0.72[a] (0.47)									

[a]highest discharge measured during the study period

Biotic Information:
Terminal reach estuary
Multiple inland waterfalls limiting upstream recruitment
20 point-quadrant biota surveys conducted biota survey at 10 ft elevation (‘o‘opu akupa and nākea observed), at 400 ft elevation at Haiku Ditch (no native species observed) with continual flow restored below Lowrie Ditch, and Haiku Ditch for four years, and at 1240 ft elevation on Hoolawanui and West Hoolawanui (‘ōpae observed).

DAR historic rankings:
Potential Heritage Stream (1998): No
Hawaii Stream Assessment Rank (1990): limited resources
US Fish and Wildlife High Quality Stream (1988): No
The Nature Conservancy Priority Aquatic Site (1985): No
National Park Service Nationwide Rivers Inventory (1982): No

Watershed Rating:
Landcover: 10/10
Shallow Waters Rating: 0/10
Stewardship Rating: 5/10
Size Rating: 2/10
Wetness Rating: 6/10
Reach Diversity Rating: 4/10
Total Score: 7/10

Riparian vegetation: hau bush in lower reaches between mouth and 400 ft (Haiku ditch)

Biological Rating:
Native Species Rating: 2/10
Introduced Genera Rating: 10/10
All Species Score: 5/10
Total Biological Rating: 5/10
Overall Rating: 6/10
Rating Strength: 5/10

Hawaii Stream Assessment
HSA aquatic resources: Low (0 high value species; 1 low value native species observed); 4 surveys, last was in 1980
HSA riparian resources: Detrimental plants (hau); Detrimental animals (pigs); 0% native forest; small palustrine wetland
HSA cultural resources: very limited survey coverage; 1 archeological site; moderate density; pre-contact/early contact, important information and culturally noteworthy; taro historically associated with stream
HSA recreational resources: hiking, swimming, scenic views; ranked a "2" by regional committee

Registered Diversions
DIV 145 EAST MAUI IRR: W-19 Wailoa Ditch from Hoolawaliilii
DIV 144 EAST MAUI IRR: W-20 Wailoa Ditch from Hoolawanui Stream
DIV 143 EAST MAUI IRR: W-21 Wailoa Ditch from West Hoolawanui Stream
DIV 234 EAST MAUI IRR: NH-19 New Hamakua Ditch from Hoolawanui Stream
DIV 244 EAST MAUI IRR: NH-20 New Hamakua Ditch from West Hoolawanui Stream
DIV 254 EAST MAUI IRR: OH-1 Old Hamakua Ditch from Hoolawanui Stream
DIV 243 EAST MAUI IRR: L-12 Lowrie Ditch from Hoolawaliilii Stream
DIV 236 EAST MAUI IRR: L-13 Lowrie Ditch from Hoolawanui Stream
DIV 237 EAST MAUI IRR: L-14 Lowrie Ditch from West Hoolawanui Stream
DIV 215 EAST MAUI IRR: H-7 Haiku Ditch from DIV 1215 WILLIAMS R: pipe from Hoolawa Stream tributary
DIV 32 BAILEY R: 2-inch pipe from spring
DIV 33 BALEY R: 2-inch pipe from spring from Hoolawa Stream
DIV 1216 WILLIAMS R: pump from Hoolawa Stream
DIV 1214 WILLIAMS R: pump #1 Hoolawa Stream
DIV 625 KIGER D: pipe from Hoolawa Stream
DIV 34 BAILEY R: pump from Hoolawa Stream
DIV 52 BICKFORD J: pipe from Hoolawa Stream
DIV 637 KLOPPING S: pump from Hoolawa Stream
DIV 83 CARR TL: pump from Hoolawa Stream
DIV 361 GARDIEN K: pipe from Hoolawa Stream
DIV 920 PALMER S: pump from Hoolawa Stream

Table 33. Registered stream diversions on the Wailoa and New Hamakua ditches in the Hoolawa hydrologic unit, East Maui.

W-19 Wailoa ditch at Hoolawaliilii	W-20 Wailoa ditch at Hoolawanui
	
NH-19 New Hamakua ditch at Hoolawanui from left bank	NH-19 New Hamakua ditch at Hoolawanui from right bank
	
W-21 Wailoa ditch at West Hoolawanui	NH-20 New Hamakua ditch at West Hoolawanui
	

Table 34. Registered stream diversions on the Old Hamakua, and Lowrie ditches and waterfalls in the Hoʻolawa hydrologic unit, East Maui.

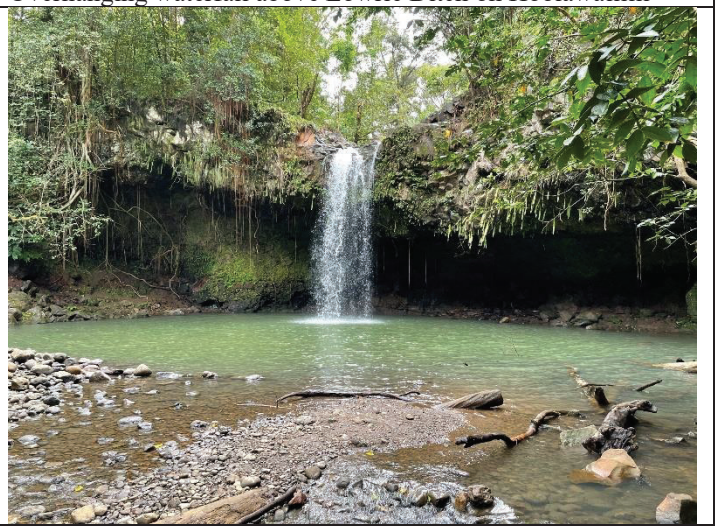
OH-1 Old Hamakua Ditch diversion dam on Hoolawanui	OH-1 Old Hamakua Ditch intake on Hoolawanui
	
L-12 Lowrie ditch inflow (on right bank) into Hoolawaliilii from left bank	L-12 Lowrie ditch at Hoolawaliilii sluice gate with continuation of ditch on left bank
	
L-13 Lowrie Ditch intake on Hoolawanui from right bank	Overhanging waterfall above Lowrie Ditch on Hoolawaliilii
	

Table 35. Stream diversions on Haiku ditch, other registered diversions, and waterfalls on Hoʻolawa Stream in the Hoʻolawa hydrologic unit, East Maui.

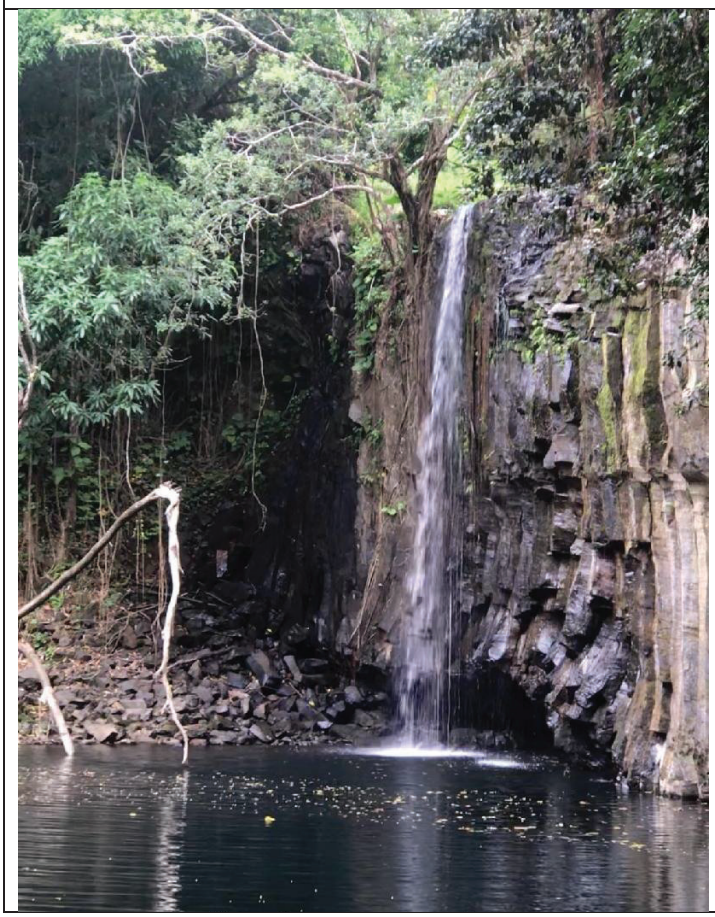
H-7 Haiku Ditch diversion dam on Hoolawa Stream	H-7 Haiku Ditch intake on Hoolawa Stream from left bank
	
Waterfall on Hoolawa Stream downstream of WILLIAMS	1-inch pipe WILLIAMS registration from Hoolawa Stream on left bank
	

Table 36. Non-East Maui Irrigation registered stream diversions and stream mouth in the Hoʻolawa hydrologic unit, East Maui.

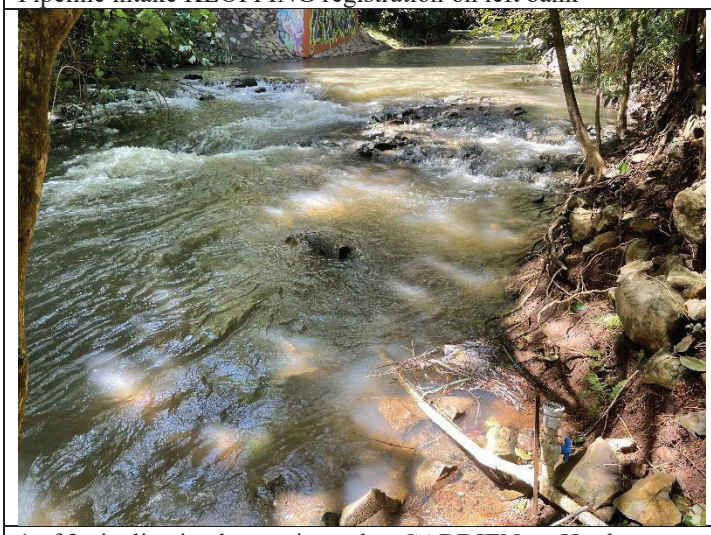
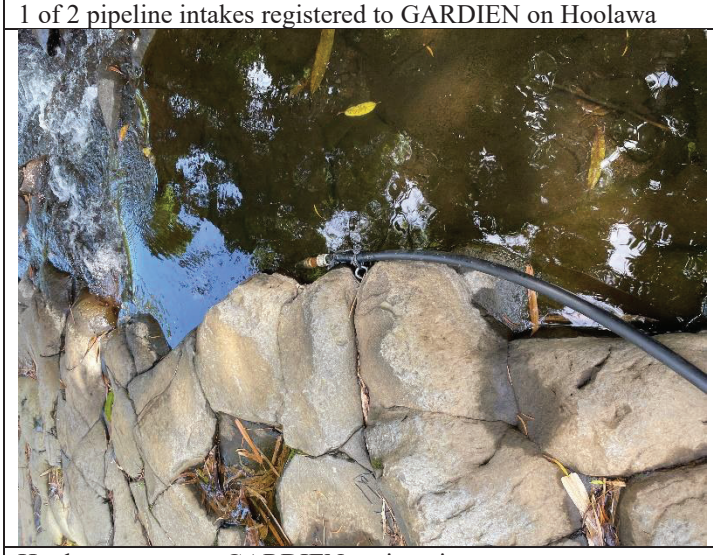
Pipeline intake KLOPPING registration on left bank	BICKFORD registration pump from Hoolawa on right bank
	
1 of 2 pipeline intakes registered to GARDIEN on Hoolawa	2 of 2 pipeline intakes registered to GARDIEN on Hoolawa
	
Hoolawa stream at GARDIEN registrations	Hoolawa stream mouth
	

Figure 32. Registered stream diversions in the Ho'olawa hydrologic unit, East Maui.

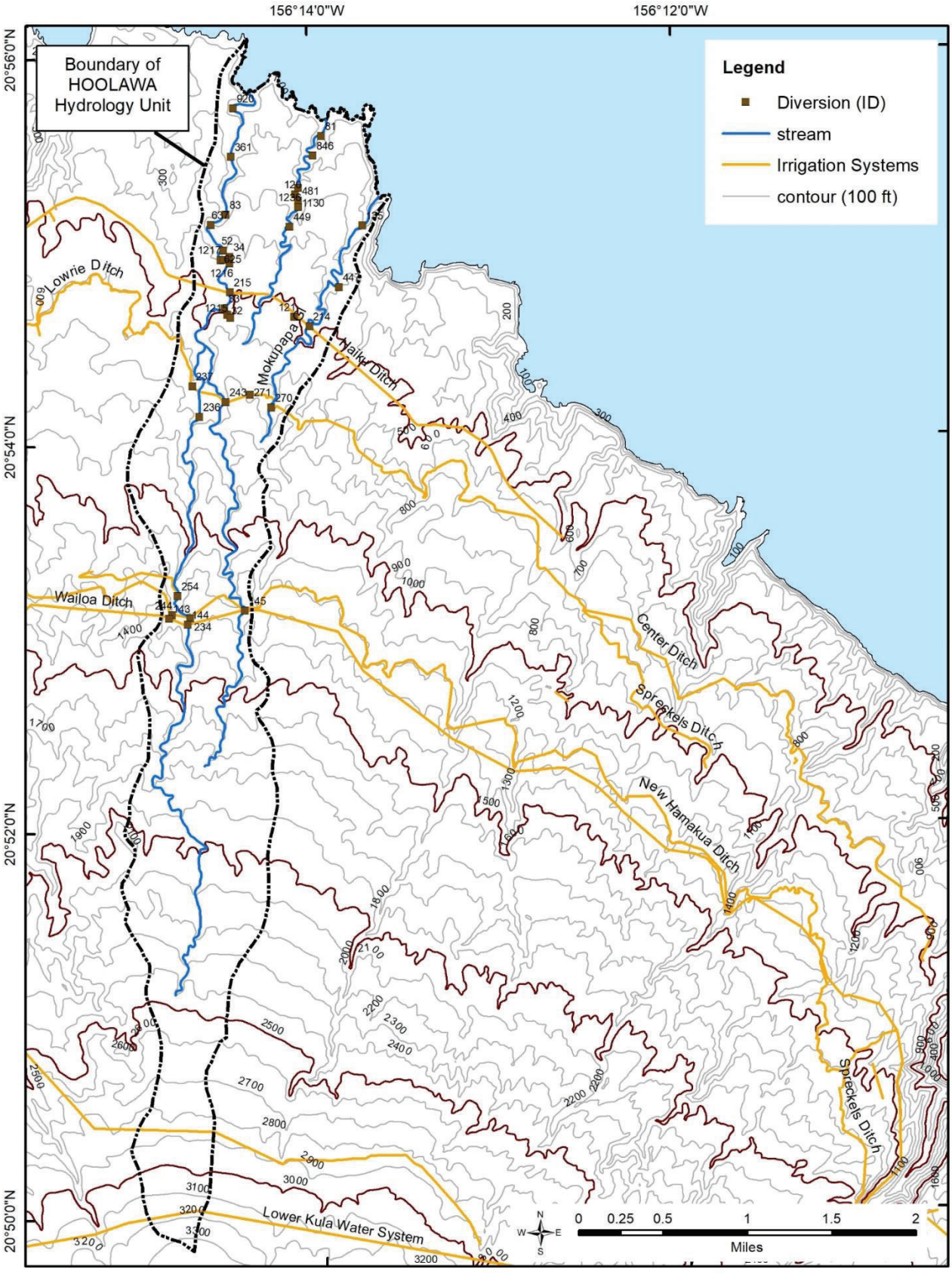


Figure 33. Seepage run results from 2020 and 2021 in the Ho'olawa hydrologic unit, East Maui.

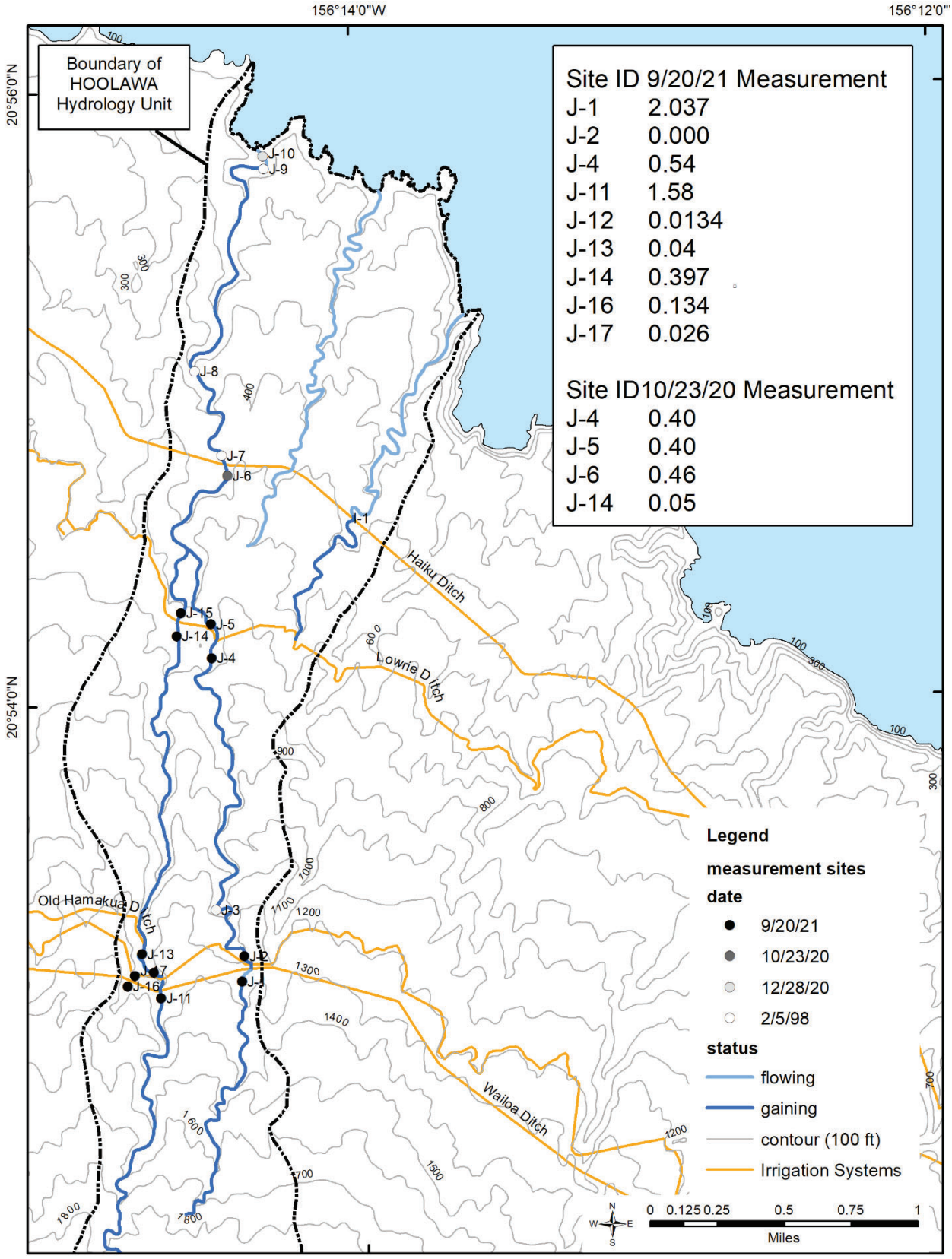


Figure 34. Seepage run results from 1998 in the Ho'olawa hydrologic unit, East Maui.

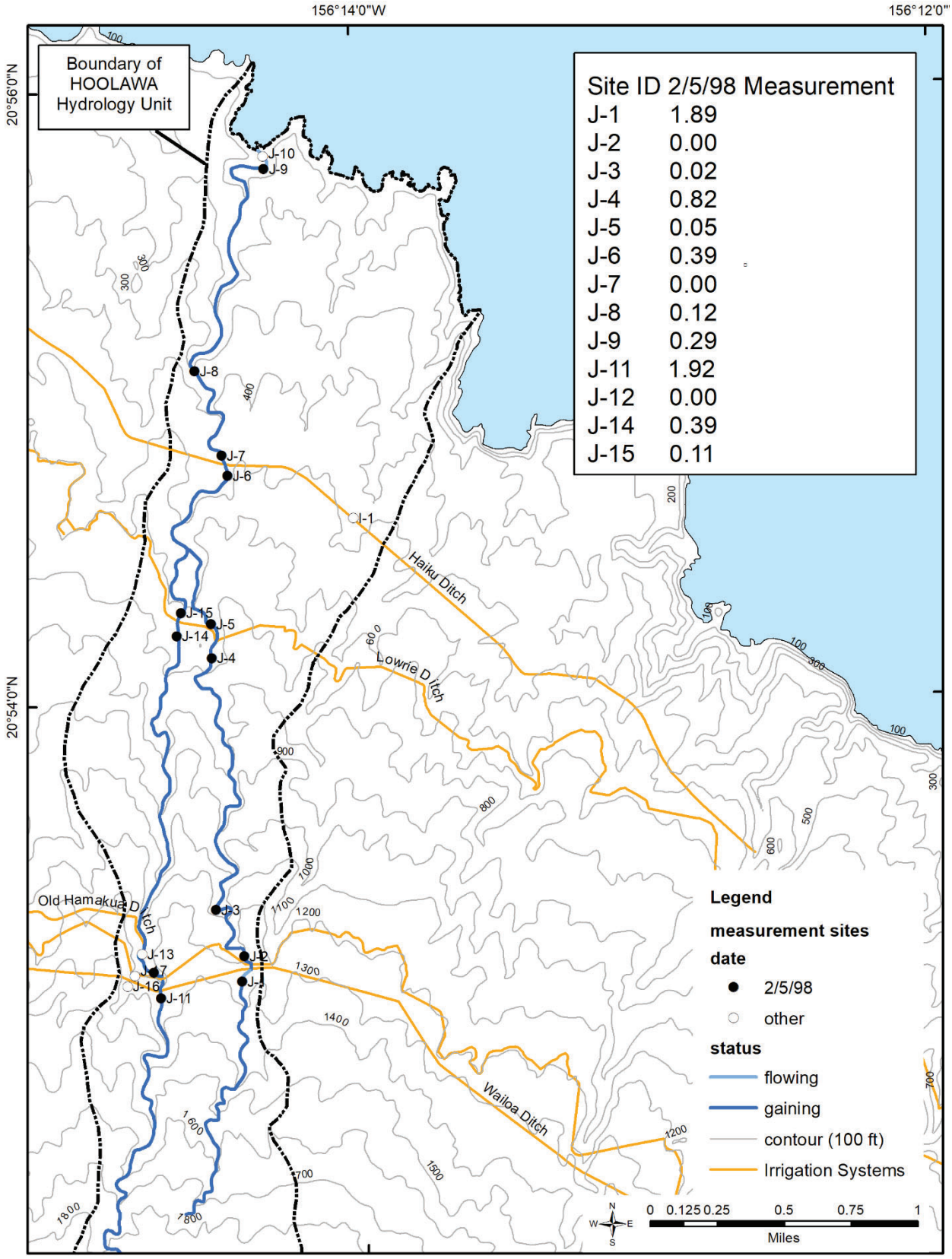
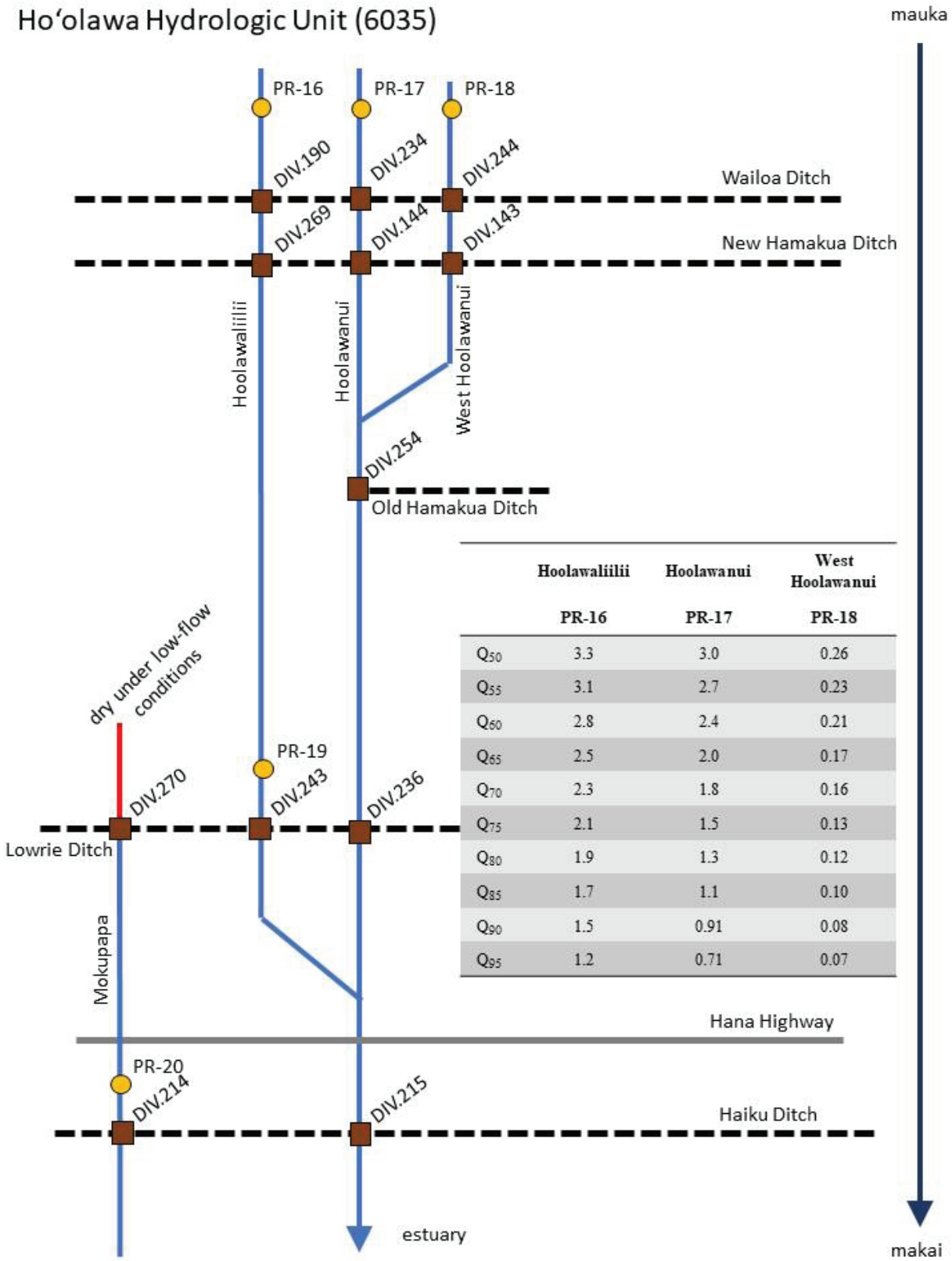


Figure 35. Generalized schematic diagram depicting the East Maui Irrigation system ditches and stream diversions and the location of the partial-record (PR) gaging stations in the Ho‘olawa hydrologic unit.



	Hoolawaliilii	Hoolawanui	West Hoolawanui
	PR-16	PR-17	PR-18
Q_{50}	3.3	3.0	0.26
Q_{55}	3.1	2.7	0.23
Q_{60}	2.8	2.4	0.21
Q_{65}	2.5	2.0	0.17
Q_{70}	2.3	1.8	0.16
Q_{75}	2.1	1.5	0.13
Q_{80}	1.9	1.3	0.12
Q_{85}	1.7	1.1	0.10
Q_{90}	1.5	0.91	0.08
Q_{95}	1.2	0.71	0.07

MOKUPAPA (HYDROLOGIC UNIT 6035)

Small stream within the Ho‘olawa hydrologic unit
- ➔ No stream specific information available
- ➔ No diversions on State-owned land

Biotic Information
No native species observed 12 site visits
Catchment Area: 0.5 mi^2
Maximum elevation: 876 ft
Total Stream Length: 2.4 mi
Terminal Order: 1

Table 37. Low-flow streamflow measurements at partial-record (PR) gaging station on Mokupapa Stream above Haiku Ditch intake, Hoolawa hydrologic unit. [all values in cubic feet per second, cfs]

Date	Measured discharge on Mokupapa Stream at PR-20
10/4/2007	0.450
1/22/2021	0.072
4/9/2021	0.064
7/19/2021	0.017
8/16/2021	0.088
1/11/2022	0.720

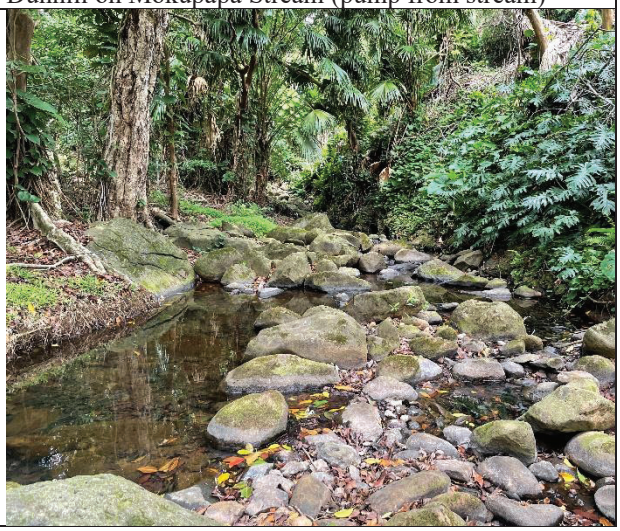
Registered Diversions
DIV 214 EAST MAUI IRR: Intake H-6 from Mokupapa Stream; also 1” pipe at bottom of intake basin provides water to the Mandoe’s (TMK 2-9-05-5,46,47,48,49)
DIV 447 HAROLD FL: Pump from Mokupapa Stream
DIV 135 DUNNILL G: Pump from Mokupapa Stream 3xmonth via 30 gpm pump to storage tank used for domestic supply and irrigation

Honokolā (Hydrologic Unit 6035)
Small stream within the Hoolawa hydrologic unit
- ➔ No stream information available
- ➔ No diversions on State-owned land

Catchment Area: 0.39 mi^2
Maximum elevation: 510 ft
Total Stream Length:1.85 mi
Terminal Order: 1

Registered Diversions
DIV 449 HARVEY EST: water from a ram pump on Honokola Stream used for non-potable domestic supply by less than 10 people.
DIV 1130 VON SHULTZE S: water pumped via 6” pipe for domestic supply at 5 service connections; water diverted from stream via open pipe to supply 10 ponds
DIV 1236 YOULIN V: water diverted via 1/2 “ gravity flow pipe and sump pump supplying a 300-gallon storage tank for domestic supply at 3 service connections
DIV 126 DAVIS W&R: water pumped into 2” pipe used for irrigation
DIV 846 MCKINNEY B&E: water diverted via 4” pipe to a 2” pipe used for 3 service connections
DIV 81 Caro J&E: water diverted via 2” pipe used for domestic supply at 5 service connections

Table 38. Haiku ditch intake and non-East Maui Irrigation diversion on Mokupapa Stream in the Ho‘olawa hydrologic unit, East Maui.

Mokupapa Stream abv Haiku Ditch	H-6 Haiku Ditch intake on Mokupapa Stream
	
1-inch pipe to non-EMI user	Location of abandoned diversion registration to Dunnill on Mokupapa Stream (pump from stream)
	

AVAILABILITY OF WATER

The flow-duration values for the total amount of surface water naturally available from the Huelo streams, as measured at the Wailoa and at the seepage gains downstream to the Lowrie Ditch, are depicted in Table 39. Additionally, the flow duration values for the total amount of surface water available in the entire East Maui Irrigation System below the Upper and Lower Kula Water Systems for the 1984-2013 climate period before and after the 2018 Decision & Order are also provided in Table 39.

Table 39. Water available from surface water sources in the Huelo region as part of the 2021 petition (i.e., without Hanehoi or Honopou), and estimated total water available in the EMI system for the 1984-2013 period before and after implementation of the 2018 Decision & Order.

	Discharge in $ft^3 s^{-1}$ (mgd) for selected percentages of time (from 50 to 95 percent) the indicated discharge was equaled or exceeded									
location	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
Huelo Region streams At Wailoa Ditch	39 (25)	34 (22)	30 (19)	25 (16)	22 (14)	19 (12)	16 (10)	14 (9.0)	11 (7.1)	8.4 (5.4)
Huelo Region stream gains between Wailoa and Lowrie ditches	9.5 (6.1)	8.5 (5.5)	7.7 (5.0)	6.2 (4.0)	5.7 (3.7)	4.8 (3.1)	4.2 (2.7)	3.5 (2.3)	3.0 (1.9)	2.4 (1.6)
Total water available in Huelo streams	48 (31)	42 (27)	37 (24)	32 (21)	28 (18)	24 (16)	20 (13)	17 (11)	14 (9.0)	11 (7.1)
1984-2013 estimated water available at Ko‘olau/Wailoa ditches	168 (109)	143 (92)	126 (81)	110 (71)	98 (63)	85 (55)	73 (47)	63 (41)	53 (34)	41 (26)
1984-2013 estimated water available after 2018 D&O IIFS implementation	107 (69)	88 (57)	75 (48)	64 (41)	56 (36)	48 (31)	39 (25)	33 (21)	27 (17)	20 (13)

NON-INSTREAM USE CONSIDERATIONS

Potable water demand

Maui DWS utilizes surface water at three different water treatment facilities, each sourcing water from different delivery systems. The Olinda and Pi‘iholo water treatment facilities primarily diverts water from the Honomanū, Haipuaena, Puohokamoa, and Waikamoi hydrologic units via the Waikamoi Flume/Upper Kula pipeline at 4500 ft in elevation, and the Lower Kula pipeline at 2800 ft in elevation, respectively. The Kamole water treatment facility utilizes water from the Wailoa Ditch, diverted as far away as Nāhiku and transported via the Koolau or from Nua‘ailua and Honomanū via the Spreckels Ditch to the Wailoa Ditch. The Olinda WTF relies upon large storage reservoirs (~130 million gallons) to provide a reliable supply the approximately 1-2 mgd of water for the Upcountry potable water system in Kula and Ulupalakua. The Pi‘iholo WTF relies upon the larger baseflows available at the 2800 ft elevation to feed the single reservoir (~50 million gallon) to supply the approximately 2-4 mgd of water to be treated for the potable

water system in Makawao, Haiku, and Pukalani. The Kamole WTF relies upon the larger capacity of the Koʻolau/Wailoa ditch to supply water to be treated for the potable water system in Haʻikū and Paia. Booster pumps allow for potable water to be pumped up to higher elevations from the Kamole WTF during drought periods to compensate for reduced streamflow available at higher elevations. This is particularly important for extended drought periods when insufficient surface water is available to meet the demands of the Upcountry Maui Water System via the Upper Kula (Olinda WTF) and Lower Kula (Piʻiholo WTF) surface water sources.

Starting in water year 2022 (October 1, 2021), Maui DWS began to report to CWRM the daily water processed at the Kamole WTF. The daily average quantity of water processed at the Kamole WTF was 4.25 cfs (2.75 mgd), with a maximum of 7.43 cfs (4.80 mgd). During a drought in the month of August 2022, the daily average quantity of water processed at the Kamole WTF was 5.21 cfs (3.37 mgd), with a maximum of 6.88 cfs (4.45 mgd). When reservoir levels drop at the Upper and Lower Kula water systems, low streamflow limits the availability of water at high elevations and the Upcountry Maui Water System is almost entirely reliant on the availability of water at Kamole WTF and the Kaupakalua well (5317-001). Other Maui DWS wells need treatment via granular activated carbon filtration and are less productive. Booster pumps at Kamole WTF are utilized to move water up to the upper parts of the delivery system.

Per the 2018 agreement between EMI and Maui DWS, EMI will make up to 18.6 cfs (12 mgd) available from Wailoa Ditch and an additional 4 mgd as needed upon notice.

The updated Maui Island Water Use and Development Plan projects a demand growth for the Upcountry Water System to 13.2 cfs (8.53 mgd) by 2035 and an additional 11.29 cfs (7.3 mgd) to meet 100% of the Upcountry Water System meter priority list. Due to logistical constraints associated with the development of additional groundwater sources, Maui DWS is planning to rely on water treated at the Kamole WTF and pumped up to higher reservoirs to meet potable water demand during drought conditions. Ensuring sufficient water is available for potable water use is a high priority.

Treating surface water has a substantial cost savings compared to the electrical costs of pumped groundwater. For example, Maui DWS Well 6-5118-002 at an elevation of 1,811 ft has a 900 gpm 600 hp submersible pump with a head of 1,880 ft that costs $118 per hour (54,000 gallons per hr; 1.296 mgd) to operate with electricity rates at $0.30 per kWh ($2,832 per day). In 2022, the 12-month moving average pumpage of 0.495 mgd would cost $1081.67 per day ($218.52 per 1000 gallons) or approximately $395,000 per year. By contrast, at a cost of $0.20 per 1000 gallons, treated surface water costs approximately $99 per day for the equivalent amount (0.495 mgd) or $36,135 per year.

Agricultural water demand

There are three existing agricultural water demands for diverted surface water from East Maui streams in the Central Aquifer Sector: commercial agriculture conducted by Mahi Pono, commercial agriculture conducted by leases in the Maui Agricultural Park, and subsistence agriculture or small commercial agriculture utilizing potable water supply delivered by Maui

DWS. The DHHL is proposing to develop commercial, subsistence, and general agriculture in the Pūlehunui and Kēōkea-Waiohuli tracts.

The largest agricultural demand is expected to be from Mahi Pono. A detailed description of the Mahi Pono Farm Plan is included in the Final Environmental Impact Statement[14]. Mahi Pono plans to farm agricultural lands that have recently been converted from sugarcane to diversified agriculture. The 1:5 year drought irrigation demand for various crops under drip irrigation are provided for a lower field (Table 40) and an upper field (Table 41).

Maui County operates the Kula Agriculture Park, with 709 acres. There are 800 acres of other farms serviced by East Maui water systems, equating to approximately 3.6-4.2 mgd of demand.

Table 40. Estimated water demand in million gallons per day (mgd) for various row and orchard crops for Tax Map Key parcel 3-8-006-003 (1213.12 acres) representing a lower Mahi Pono field in agriculture using trickle drip irrigation.

IWREDSS Crop	Hydrologic Soil Condition	Soil Conservation Service Curve No.	estimated water demand (mgd) 1 in 5 yr draught	estimated water demand (gallons) 1 in 5 yr draught	estimated water (gal/acre) 1 in 5 yr draught
Domestic Garden	n/a	77, 86, 91	3.86	3,856,000	3,179
Eucalyptus	Fair	43, 65, 76	2.11	2,110,000	1,739
Papaya	Fair	43, 65, 76	1.45	1,454,000	1,199
Lychee	Fair	43, 65, 76	3.43	3,431,000	2,828
Avacado	Fair	43, 65, 76	3.64	3,641,000	3,001
Mango	Fair	43, 65, 76	3.64	3,641,000	3,001
Citrus	Fair	43, 65, 76	3.08	3,083,000	2,541
Macadamia	Fair	43, 65, 76	3.48	3,475,000	2,865
Generic Crop	Good	67, 78, 85	3.82	3,818,000	3,147

Total surface water use for the full build-out scenario of the existing Mahi Pono farm plan has a 1:5 year drought irrigation demand estimated with IWREDSS of between 64 and 75 cfs (41.3-49.0 mgd) depending on total crop distribution. This includes the use of between 7.3 cfs and 9.3 cfs (4.7 and 6.0 mgd) of brackish groundwater available from the Paia aquifer system. Because the sustainable yield of this aquifer system is 7 mgd, pumpage must be limited to below sustainable yield until further data supports modification of the aquifer's sustainable yield. Additional brackish groundwater from the Haiku aquifer system may be available at well 6-5520-001, but the elevation of this well (59 ft a.s.l.) and existing infrastructure limits its use to lower fields.

In their Final Environmental Impact Statement (EIS) accepted by the Land Board in 2021[15], Mahi Pono's estimated non-potable water demand from all sources was 106.22 mgd, of which 85.22 mgd was from surface water sources. The estimated water demand and projected use from the Final EIS is provided in Figure 36.

[14] https://files.hawaii.gov/dlnr/ld/FEIS/FEIS-V3.pdf
[15] https://dlnr.hawaii.gov/wp-content/uploads/2021/09/D-7.pdf

Table 41. Estimated water demand in million gallons per day (mgd) for various row and orchard crops for Tax Map Key parcel 2-5-002-002 (2,451 acres) representing an upper Mahi Pono field in agriculture using trickle drip irrigation.

IWREDSS Crop	Hydrologic Soil Condition	Soil Conservation Service Curve No.	estimated water demand (mgd) 1 in 5 yr draught	estimated water demand (gallons) 1 in 5 yr draught	estimated water (gal/acre) 1 in 5 yr draught
Domestic Garden	n/a	86, 91	6.81	6,812,000	2,780
Eucalyp, yng	Fair	65, 76	3.36	3,361,000	1,371
Papaya	Fair	65, 76	2.43	2,425,000	990
Lychee	Fair	65, 76	5.85	5,851,000	2,388
Avacado	Fair	65, 76	6.23	6,233,000	2,543
Mango	Fair	65, 76	6.23	6,233,000	2,543
Citrus	Fair	65, 76	5.54	5,535,000	2,259
Macadamia	Fair	65, 76	5.95	5,950,000	2,428
Generic Crop	Good	78, 85	6.63	6,631,000	2,706

AVAILABILITY OF ALTERNATIVE SOURCES

There are two potential alternative water sources that may be used to meet the needs of non-instream uses: 1) R1 recycled wastewater is available from the Pukalani Wastewater Treatment Facility (<1 mgd) and R2 recycled wastewater is available from the Kahului Wastewater Treatment Facility (4-6 mgd) (i.e., recycled water alternatives; 2) groundwater from the Kahului, Paia, Makawao, or Haiku aquifer systems (i.e., groundwater alternatives).

Recycled Water Alternatives

Wastewater treated to the R1 level can be used for row crop irrigation, while wastewater treated to the R2 level is limited to orchard irrigation. Historically, some of the sugarcane produced by Hawaiian Commercial and Sugar was irrigated with recycled water. However, due to the integrated nature of the current irrigation system (i.e., both row crop and orchards are irrigated with the same sourced water), it is not possible to utilize the R2-level water. If Maui County were to upgrade the Kahului Wastewater Treatment Facility, then this source of water would be available for agricultural uses.

Figure 36. Final EIS projected water demand by crop and total water demand for Mahi Pono's diversified agricultural plan.

Item	Multiplier or Source	Baselines			Alternative Future Water Leases		Units
		Typical Sugar	Recent Sugar	Post Sugar	Limited to D&O	No Lease	
3.a. CENTRAL MAUI							
Sugar operations							
Applied water use (after system losses)							
Upper fields (surface water only)	Share based on	62.28	55.61				mgd
Lower fields (surface and brackish water)	Acreage Split	80.90	76.84				mgd
Total water use, sugarcane	Table 1. Section 1.b	**143.19**	**132.45**				mgd
Per acre		4,866	4,368				gad
Surface water	Table 1. Section 1.b	112.07	81.24				mgd
Upper fields	From above	62.28	55.61				mgd
Lower fields	Residual	49.79	25.63				mgd
Brackish water, lower fields	Table 1. Section 1.b	31.12	51.21				mgd
Share of Total water use		21.7%	38.7%				
Share of water use, lower fields		38.5%	66.6%				
Gross Water Use (before system losses)							
Surface	Percentage losses	144.98	105.57				mgd
Brackish	from Table 1, Section 1.b	40.26	66.55				mgd
Total water requirements		185.24	172.13				mgd
Diversified Ag							
Applied water use (after system losses)							
Upper fields, irrigated (surface water only)							
Community Farm	3,392 gad				-	-	mgd
Orchards (citrus, mac nuts, beverage crops)	5,089 gad				25.39	8.24	mgd
Tropical fruits	4,999 gad				-	-	mgd
Row and annual crops	3,392 gad				1.02	0.68	mgd
Energy crops	3,392 gad				-	-	mgd
Pasture, irrigated	1,161 gad				1.28	1.04	mgd
Total, upper fields, irrigated					27.69	9.97	mgd
Average per acre					4,333	3,665	gad
Lower fields, Irrigated (surface and brackish water)							
Community Farm	3,392 gad				2.71	1.02	mgd
Orchards (citrus, mac nuts, beverage crops)	5,089 gad				40.00	13.03	mgd
Tropical fruits	4,999 gad				3.00	1.00	mgd
Row and annual crops	3,392 gad				3.05	0.68	mgd
Energy crops	3,392 gad			0.68	1.70	0.68	mgd
Pasture, irrigated	1,161 gad				4.18	3.37	mgd
Adjustment					0.01	(0.02)	mgd
Total, lower fields, irrigated				0.68	54.65	19.75	mgd
Average Per acre					3,832	3,105	gad
Total diversified Ag				0.68	**82.34**	**29.72**	mgd
Average per acre					3,987	3,273	gad
Water use, by source							
Surface water	Residual				65.87	23.77	mgd
Upper fields					27.69	9.97	mgd
Lower fields					38.18	13.81	mgd
Brackish water, lower fields	20.0% of Total				16.47	5.94	mgd
Share of Total					20.0%	20.0%	
Share of lower fields					30.1%	30.1%	
Gross water use (before system losses)							
Surface	22.7% losses				85.22	30.75	mgd
Brackish	22.7% losses				21.30	7.69	mgd
Total gross water requirements				ne.	**106.52**	**38.44**	**mgd**

Groundwater Alternative

The sustainable yields, current (2021) 12-month moving average, and 5-year average for the Kahului, Paia, Makawao, and Haiku aquifer systems are provided in Table 42. The sustainable yield was exceeded in the Kahului aquifer system every month from 2017 to 2022. Wells in the Paia aquifer system operated by both Maui County DWS and Mahi Pono are relied upon during drought periods to supplement the lack of surface water available for potable and non-potable needs. The 2021 12-month moving average pumpage in the Paia aquifer system was 2.439 mgd compared to a sustainable yield of 7 mgd, with a maximum monthly pumpage of 6.410 mgd. Relative to their sustainable yields, there is little pumpage from the Makawao and Haiku aquifer systems.

Table 42. Current sustainable yields for aquifer systems in the Central Aquifer Sector and current (2021) 12-month moving average (MAV) pumpage, 2017-2022 5-year average reported pumpage, and maximum reported monthly pumpage. [million gallons per day, mgd]

System	Sustainable Yield (mgd)	2021 12-month MAV (mgd)	2017-2022 5-year average (mgd)	2017-2022 Maximum Pumpage (mgd)
Kahului	1	3.048	5.551	9.632
Paia	7	2.439	0.877	6.410
Makawao	7	0.673	0.579	1.713
Haiku	24	0.912	0.869	1.195

Maui Department of Water Supply Groundwater Sources

Maui DWS operates six wells that service their Upcountry Water System, although only five have been utilized in any capacity in the last five years (Table 43). This system integrates the groundwater from these wells with treated surface water from the three upcountry surface water treatment facilities (WTF): Olinda WTF, Piiholo WTF, and Kamole WTF. Groundwater pumpage to service the Upcountry Water System is extremely costly, due to the elevation of the population. Further, many of the Maui DWS wells are located below historic pineapple fields, which leached legacy pesticides into the groundwater system, necessitating additional treatment before distribution.

Table 43. Wells registered to Maui DWS servicing the Upcountry Water System, current (2021) 12-month moving average (MAV) pumpage, and 10-year average pumpage. [million gallons per day, mgd]

Well ID	Well name	Aquifer System	2021 12-month MAV (mgd)	2017-2022 5-year average pumpage (mgd)
6-5420-002	Hamakuapoko 1	Paia	0.018	0.007
6-5320-001	Hamakuapoko 2	Paia	0.025	0.009
6-5420-001	Old Maui HS	Paia	0.000	0.000
6-5118-002	Pookela MDWS	Makawao	0.246	0.217
6-5419-001	Haiku	Haiku	0.257	0.271
6-5317-001	Kaupakulua MDWS	Haiku	0.565	0.562

Mahi Pono Groundwater Sources

Mahi Pono operates two wells in the Kahului aquifer system which service the Ma‘alaea fields in combination with surface water from West Maui streams. These wells do not service the fields supplied by surface water from East Maui. Mahi Pono operates nine wells in the Paia aquifer system and one well in the Ha‘iku aquifer system which is combined with surface water to support non-potable irrigation demand (Table 44). From 2017-2022, the 5-year average pumpage from the Paia aquifer system was 0.534 mgd. Mahi Pono does not have any wells in the Makawao aquifer system. Historic pumping rates from the Haiku, Paia, and Kahului aquifers that exceeded sustainable yields was possible because of the large volumes of imported surface water that augmented recharge in the region. With the reduction in recharge associated with reduced irrigation usage, these historic pumping rates are not sustainable. Given the current (2021) 12-month moving average of pumpage, there is approximately 4.5 mgd available from the Paia aquifer system, where most of Mahi Pono wells are located (Figure 37). Almost all wells are located at the lowest elevation ditch (Haiku Ditch) and could not be used to service the upper fields.

IMPLICATIONS OF WATER RESERVATION

Should the Commission approve this water reservation, the water reservation will be documented in the Water Resource Protection Plan, along with the prior-approved water reservations. The reservation will be included in the calculation of authorized planned use for consideration in water management area designation. Upon the designation of any of the hydrologic units as surface water management areas, staff will initiate review and rule-making pursuant to HRS §174C-49(d) and Hawaii Administrative Rule §13-171-60(b).

The utilization of 1.3275 mgd (2.05 cfs) of surface water from the Huelo streams represents approximately 19% of the estimated 11 cfs natural low (Q_{95}) streamflow available and approximately 4% of the estimated 48 cfs natural median (Q_{50}) streamflow available.

In the Final EIS, the water available State Leased lands following the implementation of the 2018 Decision & Order was estimated to be approximately 136 cfs (88 mgd), with an additional 6.8 cfs (4.4 mgd) from non-state lands and approximately 23.2 cfs (16 mgd) from brackish groundwater sources. It is expected that the proposed modifications to the system in the Huelo region will reduce the availability of water for non-instream uses during median (Q_{50}) flow by about 21 cfs (15.5 mgd) or 44%, and during low-flow (Q_{95}) by about 5.3 cfs (3.4 mgd) or 49% (Table 45). The proposed system modifications are expected to reduced availability of water for non-instream uses. Staff recommends that a water shortage plan be developed so that under drought conditions, stakeholders will be able to coordinate among public trust and reasonable and beneficial uses.

Table 44. Wells registered to Mahi Pono servicing their irrigation needs of the Central Aquifer Sector, current (2021) 12-month moving average (MAV) pumpage, and 5-year average pumpage. [million gallons per day, mgd]

Well ID	Well name	Aquifer System	2021 12-month MAV (mgd)	2017-2022 5-year average pumpage (mgd)
6-4825-001	Kihei Shaft	Paia	<0.001	0.000
6-5323-001	Paia-Pump 2	Paia	0.001	0.001
6-5321-001	Kaheka-Pump 18	Paia	0.000	0.000
6-5520-001	Maliko Pump 11	Paia	0.000	0.000
6-5522-001	Kuau Pump 12	Paia	0.295	0.236
6-5422-001	Paia Mill-Pump 13	Paia	0.373	0.298
6-5422-002	Paia-Pump 17	Paia	0.000	0.000
6-5424-001	HC&S 4	Paia	0.000	0.000
6-5226-002	Puunene-Pump 6	Paia	0.000	0.000
6-5520-001	Maliko Pump 11	Haiku	0.000	0.000
6-5224-002	Puunene-Pump 9	Kahului	0.000	0.001
6-5128-002	Waikapu Sh-Pump 7	Kahului	0.181	0.106

SUMMARY OF PUBLIC TRUST USES OF SURFACE WATER

Water in its natural state, water for domestic consumption, water for traditional and customary practices of Native Hawaiians, and water reserved for the DHHL are public trust uses of water. In Table 45 are selected low-flow duration values for the total available water from the Huelo region hydrologic units (without water available from the Hanehoi or Honopou hydrologic units) in the EMI water system. The median flow used for potable water supply at Kamole WTF is approximately 4.8 cfs (3.12 mgd) but during drought, such as at Q_{90} flow, when there is less water available in the Upper and Lower Kula water systems, demand at the Kamole WTF increases to 6.7 cfs (4.32 mgd). When 2.05 cfs (1.3275 mgd) is utilized by DHHL from the Huelo streams, approximately 20 cfs (13.2 mgd) is available from the Huelo streams for diversified agriculture. In a drought the availability of water is for diversified agriculture is limited.

STAKEHOLDER MEETINGS

Following informational briefings to the Commission in July, August, and September 2022, including a draft recommendation proposing modifications to or abandonments of specific stream diversion structures to better protect instream uses, Commission staff met individually with DHHL, Mahi Pono, and twice with Sierra Club. Following these discussions, modifications to the staff submittal have been made to address concerns and provide clarification, where appropriate.

Figure 37. Aquifer system boundaries, sustainable yields, and well locations with well ID for wells registered to Mahi Pono.

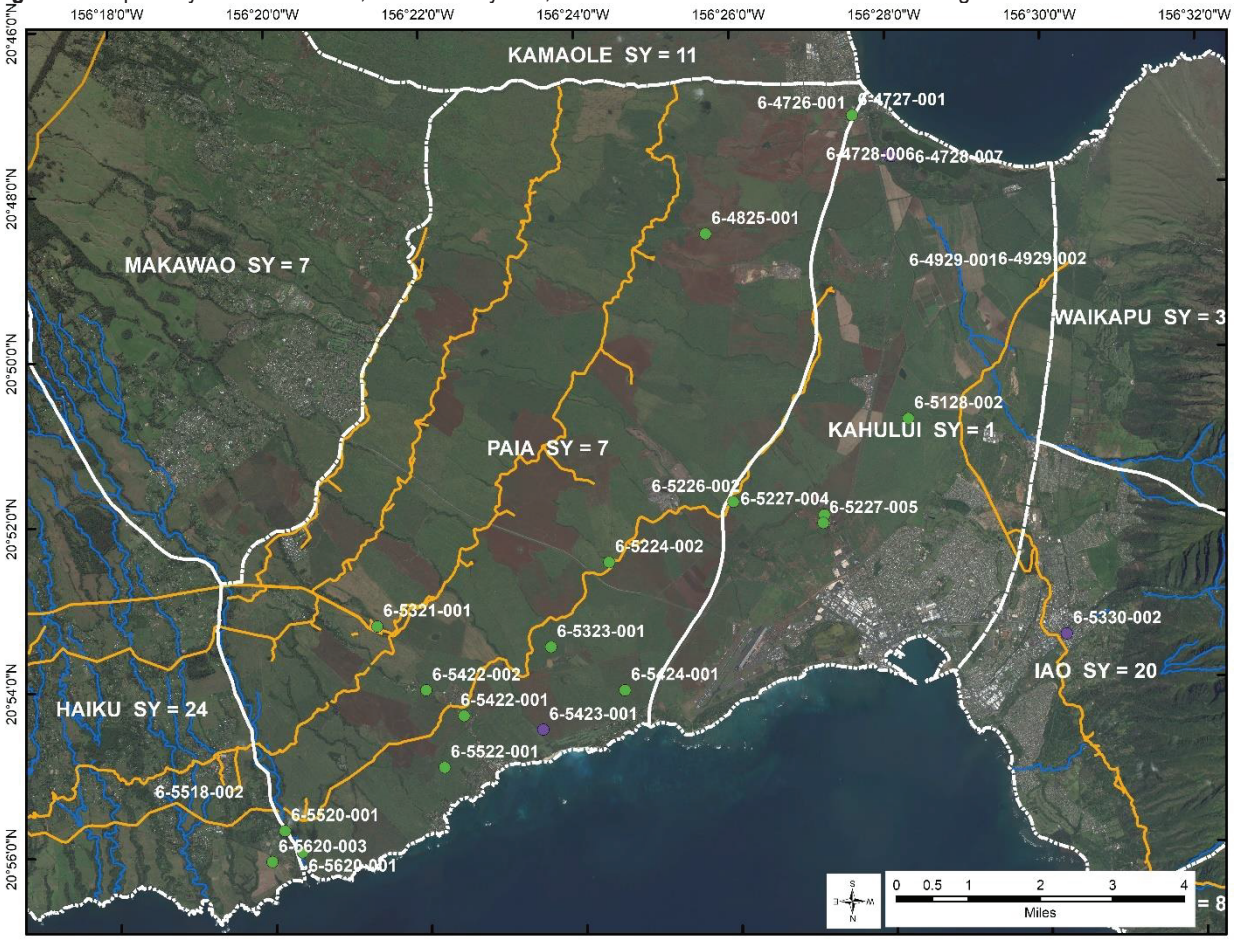


Table 45. Total water available in cubic feet per second, cfs (million gallons per day, mgd) from surface water sources in the Huelo region for the 1984-2013 period (i.e., without Hanehoi or Honopou), estimated water kept in stream following modifications to the EMI system, estimated water used for public trust purposes (Maui DWS drinking water supply and DHHL) and availability of water for non-public trust, non-instream uses.

1984-2013 period	Discharge for selected percentages of time (from 50 to 95 percent) the indicated discharge was equaled or exceeded									
	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
Water available in Huelo streams	48 (31.3)	42 (27.2)	37 (24.2)	32 (20.4)	28 (17.9)	24 (15.4)	20 (13.2)	17 (11.1)	14 (9.17)	11 (6.99)
Water kept in streams	21 (13.5)	19 (12.1)	17 (10.9)	14 (8.92)	13 (8.20)	11 (6.94)	9.3 (5.98)	7.9 (5.09)	6.6 (4.29)	5.3 (3.42)
Reservation of water for DHHL	2.05 (1.33)	2.05 (1.33)	2.05 (1.33)	2.05 (1.33)	2.05 (1.33)	2.05 (1.33)	2.05 (1.33)	2.05 (1.33)	2.05 (1.33)	2.05 (1.33)
Maui DWS Kamole Water Treatment Facility*	4.8 (3.12)	4.9 (3.17)	5.0 (3.21	5.1 (3.27)	5.2 (3.36)	6.0 (3.86)	6.4 (4.16)	6.6 (4.26)	6.7 (4.32)	6.8 (4.41)
Water available for diversified agriculture	20 (13.2)	16 (10.6)	13 (8.66)	11 (6.84)	7.7 (4.97)	5.0 (3.22)	2.66 (1.72)	0.64 (0.41)	--	--

*water may be made available for Maui DWS sourced from other streams East of Huelo to meet demand

RECOMMENDATIONS

The 2018 Decision & Order had a goal of being realistically implemented, measurable, understood by stakeholders, and to reasonably accommodate non-instream uses under the current conditions, such that on-going monitoring can be used to adapt to changing circumstances. Staff have considered these tenets in its recommendations presented here.

1. Reservation of Non-Potable Water for Department of Hawaiian Home Lands
Staff recommends that the Commission approve a water reservation of 2.05 cfs (1.3275 mgd) for the Department of Hawaiian Home Lands (DHHL) to meet their foreseeable future non-potable water needs serviced by the East Maui Irrigation System from the Huelo Streams.

ACTION 1.1: Approve a reservation of 2.05 cfs (1.3275 mgd) for DHHL from the East Maui Irrigation System from the Huelo region streams.

IMPLEMENTATION

Staff will coordinate between DHHL and East Maui Irrigation/Mahi Pono, to determine the infrastructure needed to transport the recommended reservation of water to the Pūlehunui development.

2. Summary of Recommendations to Protect Instream Uses

Each stream in the Huelo region of East Maui is a gaining stream with spring flow from perched groundwater held in the Kula Volcanics supporting surface water. In some reaches, groundwater gains are sufficient to meet recognized instream uses of water. In some reaches, additional flow must be provided to meet recognized instream uses of water. A depiction of low-flow streamflow at various elevations, the irrigation systems, and streams with diversions to be abandoned, modified, or remain projected following Commission action is provided in Exhibit 10.

Commission staff make the following conclusions regarding instream uses in the Huelo region:

1. There is a need to ensure downstream flows below the Lowrie Ditch are sufficient for recognized riparian uses in the Hoʻolawa, Waipiʻo, and Hānawana hydrologic units.

2. There is a need to ensure downstream flows below the Center and Spreckels, or Lowrie and Haiku ditches sufficient for aquatic habitat in the Hoʻolawa, Nailiilihaele, and ʻOʻopuola hydrologic units.

3. There is a need to ensure downstream flows are sufficient for recreational uses immediately above the Lowrie ditch in the Hoʻolawa, Kailua, and Nailiilihaele hydrologic units, as well as below the Lowrie and Haiku ditches in the Hoʻolawa hydrologic unit.

4. There is a need to increase available habitat for the endangered damselfly *Magalagrion pacificum* in East Kōlea.

To ensure that instream uses are sufficiently protected while providing for both non-instream public trust uses and the reasonable and beneficial uses of water for agriculture, staff recommends the following modifications to the East Maui Irrigation System.

2.1 RECOMMENDATION: Kōlea Hydrologic Unit

Proposed Management
Increase the length of stream habitat available for *M. pacificum* without increasing the upstream movement of non-native fish in East Kōlea.

Proposed Modifications for Implementation
Modify DIV.156 (W-3) and DIV.209 (NH-2) intakes such that all flows up to 0.08 cfs remain in the stream without providing for connectivity.

ACTION 2.1: Order EMI to modify intakes such that all flows up to 0.08 cfs (0.05 mgd) flow past Diversion 156 and Diversion 209 on East Kōlea Stream.

2.2 RECOMMENDATION: Punalu‘u Hydrologic Unit

Proposed Management
Non-instream water use

Proposed Modifications for Implementation
None

2.3 RECOMMENDATION: Ka‘aiea Hydrologic Unit

Proposed Management
- Continual flow past Spreckels and Center ditches for aquatic habitat

Proposed Modifications for Implementation
- Continual flow past DIV.232 (S-11): 18-inch plate across grate to transport all baseflow up to 1.8 cfs; fix leaks in wing wall
- Continual flow past DIV 194 (C-5): 18-inch plate across grate to transport all baseflow up to 1.8 cfs; fix leaks in upstream concrete and wing walls

Proposed modifications are expected to result in the following flow duration curves for specific locations in the Ka‘aiea Hydrologic Unit:

site name	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
Ka‘aiea Stream abv Spreckels Ditch	0.27 (0.17)	0.24 (0.16)	0.22 (0.14)	0.18 (0.11)	0.16 (0.11)	0.14 (0.09)	0.12 (0.08)	0.10 (0.07)	0.09 (0.06)	0.07 (0.05)
Ka‘aiea Stream abv Center Ditch	0.39 (0.25)	0.36 (0.23)	0.34 (0.22)	0.30 (0.19)	0.28 (0.18)	0.26 (0.17)	0.24 (0.16)	0.22 (0.14)	0.21 (0.13)	0.19 (0.12)

ACTION 2.3.1: Order EMI to modify the intake such that all flows up to 1.8 cfs (1.12 mgd) flow past Diversion 232 on Ka‘aiea Stream and provide for habitat connectivity.

ACTION 2.3.2: Order EMI to modify the intake such that all flows up to 1.8 cfs (1.12 mgd) flow past Diversion 194 on Ka‘aiea Stream and provide for habitat connectivity.

2.4 RECOMMENDATION: ‘O‘opuola Hydrologic Unit

Proposed Management
- Increased flow below Wailoa/New Hāmākua ditches for aquatic habitat
- Continual flow past Spreckels and Center ditches for aquatic habitat

Proposed Modifications for Implementation
- Abandonment of DIV 173 (W-7): remove PVC piping
- Abandonment of DIV 150 (W-9): remove PVC piping, seal intake
- Abandonment of DIV 262 (NH-6): remove PVC piping, seal intake

- Continual flow past DIV 142 (W-10): pipe past intake from pool above to transport all flows up to 0.36 cfs
- Abandonment of DIV 260 (NH-8): seal intake
- Continual flow past DIV 308 (S-13): 18-inch plate across grate to transport all baseflow up to 1.8 cfs
- Continual flow past DIV 196 (C-7): 18-inch plate across grate, seal leakage along upstream edge to transport all baseflow up to 1.8 cfs

Proposed modifications are expected to result in the following flow duration curves for specific locations in the ʻOʻopuola Hydrologic Unit:

site name	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
ʻOʻopuola Stream	0.69	0.61	0.56	0.48	0.43	0.38	0.34	0.30	0.25	0.20
abv Spreckels Ditch	(0.45)	(0.40)	(0.36)	(0.31)	(0.28)	(0.24)	(0.22)	(0.19)	(0.16)	(0.13)
ʻOʻopuola Stream	0.72	0.64	0.59	0.51	0.46	0.41	0.37	0.33	0.28	0.23
abv Center Ditch	(0.47)	(0.42)	(0.38)	(0.33)	(0.30)	(0.26)	(0.24)	(0.21)	(0.18)	(0.15)

ACTION 2.4.1: Order EMI to seal and abandon Diversion 173 on Makanali Stream.

ACTION 2.4.2: Order EMI to seal and abandon Diversion 150 on ʻOʻopuola Tributary Stream.

ACTION 2.4.3: Order EMI to seal and abandon Diversion 262 on ʻOʻopuola Tributary Stream.

ACTION 2.4.4: Order EMI to modify the intake such that all flows up to 0.36 cfs (0.23 mgd) flow past Diversion 142 on West ʻOʻopuola Stream.

ACTION 2.4.5: Order EMI to seal and abandon Diversion 260 on West ʻOʻopuola Stream.

ACTION 2.4.6: Order EMI to modify the intake such that all flows up to 1.8 cfs (1.12 mgd) flow past Diversion 308 on ʻOʻopuola Stream and provide for habitat connectivity.

ACTION 2.4.7: Order EMI to modify the intake such that all flows up to 1.8 cfs (1.12 mgd) flow past Diversion 196 on ʻOʻopuola Stream and provide for habitat connectivity.

2.5 RECOMMENDATION: Puehu Hydrologic Unit

Proposed Management

- Non-instream water use

Proposed Modifications for Implementation

- None

2.6 RECOMMENATION: Nailiilihaele Hydrologic Unit

Proposed Management

- Increased flow below the Wailoa/New Hāmākua ditches for aquatic habitat and recreational uses

Proposed Modifications for Implementation

- Continual flow past DIV 168 (W-14): 18-inch plate across grate to provide connectivity
- Continual flow past DIV 267 (NH-12): increase intake invert to maintain flow past dam (e.g., build a "chimney intake" or seal intake)
- Continual flow past DIV 255 (NH-13): increased invert at intake (e.g., build a "chimney intake" or seal intake)
- Continual flow past DIV 187 (L-1): maintain wetted path over dam via notch in concrete to transport all flows up to 5.2 cfs downstream

Proposed modifications are expected to result in the following flow duration curves for specific locations in the Nailiilihaele Hydrologic Unit:

site name	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
Nailiilihaele Stream	2.6	2.2	2.0	1.7	1.5	1.2	1.1	0.9	0.74	0.56
abv New Hamakua Ditch	(1.68)	(1.42)	(1.28)	(1.10)	(0.94)	(0.80)	(0.69)	(0.58)	(0.48)	(0.36)
Nailiilihaele Stream	3.9	3.5	3.3	3.0	2.8	2.5	2.4	2.2	2.0	1.9
abv Papaaea Feeder Ditch	(2.52)	(2.26)	(2.12)	(1.94)	(1.78)	(1.64)	(1.53)	(1.42)	(1.32)	(1.20)
Nailiilihaele Stream	7.5	7.1	6.8	6.5	6.2	5.9	5.7	5.5	5.3	5.1
abv Lowrie Ditch	(4.87)	(4.57)	(4.40)	(4.17)	(4.00)	(3.82)	(3.68)	(3.56)	(3.43)	(3.30)

ACTION 2.6.1: Order EMI to modify the intake such that 20% of all flows flow past Diversion 168 on Nailiilihaele Stream and provide for habitat connectivity and recreational uses.

ACTION 2.6.2: Order EMI to modify the intake such that all flows up to 1.8 cfs (1.12 mgd) flow past Diversion 267 on Nailiilihaele Stream and provide for habitat connectivity and recreational uses.

ACTION 2.6.3: Order EMI to modify the intake such that all flows up to 3.6 cfs (2.32 mgd) flow past Diversion 255 on Nailiilihaele Stream to provide for habitat connectivity and recreational uses.

ACTION 2.6.4: Order EMI to modify the intake such that all flows up to 5.2 cfs (3.36 mgd) flow past Diversion 187 on Nailiilihaele Stream to provide for habitat connectivity.

2.7 RECOMMENDATION: Kailua Hydrologic Unit

Proposed Management

- Increased flow below Wailoa/New Hāmākua ditches for recreational uses

Proposed Modifications for Implementation

- Continued flow past DIV 185 (W-15): 18-inch plate across grate to transport all flow up to 1.8 cfs
- Abandon DIV 273 (NH-14): seal intake

Proposed modifications are expected to result in the following flow duration curves for specific locations in the Kailua Hydrologic Unit:

site name	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
Kailua Stream abv Lowrie Ditch	2.4 (1.52)	2.1 (1.33)	1.8 (1.16)	1.5 (0.94)	1.3 (0.82)	1.1 (0.72)	0.93 (0.60)	0.73 (0.47)	0.59 (0.38)	0.42 (0.27)

ACTION 2.7.1: Order EMI to modify the intake such that 20% of all streamflows flow past Diversion 185 on Kailua Stream and provide for habitat connectivity and recreational uses.

ACTION 2.7.2: Order EMI to seal and abandon Diversion 273 on Oanui Stream to provide for downstream habitat and recreational uses.

2.8 RECOMMENDATION: Hānawana Hydrologic Unit

Proposed Management

- Continual flow past Lowrie Ditch for riparian uses

Proposed Modifications for Implementation

- Modification of existing pipe across DIV 177 (L-13) to prevent clogging

ACTION 2.8.1: Order EMI to modify the bypass pipe across Lowrie Ditch to maintain a continual flow of water to meet downstream riparian uses

2.9 RECOMMENDATION: Hoalua Hydrologic Unit

Proposed Management

- Non-instream water use

Proposed Modifications for Implementation

- None

2.10 RECOMMENDATION: Waipi‘o Hydrologic Unit

Proposed Management

- Increased flow below Lowrie ditch for riparian uses

Proposed Modifications for Implementation

- Abandon DIV.238 (L-8) on Waipi‘o stream

ACTION 2.10.1: Order EMI to seal and abandon Diversion 238 on Waipio Stream to provide for downstream riparian uses.

2.11 RECOMMENDATION: Ho‘olawa Hydrologic Unit

Proposed Management

- Increased flow below Wailoa/New Hāmākua ditches for recreational uses and aquatic habitat uses
- Increased flow below Lowrie/Haiku ditches for recreational, riparian, and aquatic habitat uses

Proposed Modifications for Implementation

- Continual flow past DIV 144 (W-19): 18-inch plate across grate
- Continual flow past DIV 145 (W-20): 18-inch plate across grate
- Abandon and seal DIV 234 (NH-19)
- Continual flow past DIV 244 (NH-20): 18-inch plate
- Abandon and seal DIV 254 (OH-1)
- Continual flow past DIV 243 (L-12): support current leakage underneath diversion dam with PVC piping from Lowrie ditch to ensure 0.7 cfs continues downstream
- Continual flow past DIV 236 (L-13): support current bypass channel in bedrock by ensuring all flows up to 1.2 cfs continue downstream from the intake
- Continual flow past DIV 215 (H-7): seal holes in intake wall and raise invert of ditch at intake such that all flows up to 3.0 cfs continue downstream.

Proposed modifications are expected to result in the following flow duration curves for specific locations in the Ho‘olawa Hydrologic Unit:

site name	Q_{50}	Q_{55}	Q_{60}	Q_{65}	Q_{70}	Q_{75}	Q_{80}	Q_{85}	Q_{90}	Q_{95}
Hoolawaliilii Stream	1.5	1.4	1.2	1.0	1.0	0.84	0.74	0.65	0.56	0.45
abv Lowrie Ditch	(0.95)	(0.87)	(0.79	(0.67)	(0.62)	(0.54)	(0.48)	(0.42)	(0.36)	(0.29)
Hoolawanui Stream	1.8	1.6	1.5	1.3	1.2	1.04	0.93	0.82	0.71	0.59
abv Lowrie Ditch	(0.16)	(1.06)	(0.96)	(0.83)	(0.77)	(0.67)	(0.60)	(0.53)	(0.46)	(0.38)
Ho‘olawa abv Haiku	3.4	3.1	2.8	2.4	2.3	2.0	1.8	1.6	1.4	1.2
Ditch	(2.20)	(2.01)	(1.83)	(1.58)	(1.47)	(1.30)	(1.17)	(1.03)	(0.91)	(0.76)

ACTION 2.11.1: Order EMI to modify the intake such that a 20% of all streamflow flows past Diversion 145 on Hoolawaliilii Stream to provide for recreational uses.

ACTION 2.11.2: Order EMI to modify the intake such that a 20% of all streamflow flows past Diversion 144 on Hoolawanui Stream to provide for habitat connectivity and recreational uses.

ACTION 2.11.3: Order EMI to modify the intake such that a 20% of all streamflow flows past Diversion 244 on West Hoolawanui Stream to provide for downstream habitat and recreational uses.

ACTION 2.11.4: Order EMI to seal and abandon Diversion 234 on Hoolawanui Stream to provide for downstream habitat and recreational uses.

ACTION 2.11.5: Order EMI to modify the intake such that a continual flow of 0.7 cfs (0.45 mgd) flows below Diversion 243 on Hoolawaliilii Stream to provide for recreational uses and downstream habitat.

ACTION 2.11.6: Order EMI to modify the intake such that all streamflow up to 1.2 cfs (0.78 mgd) flows below Diversion 236 on Hoolawanui Stream to provide for recreational uses and downstream habitat.

ACTION 2.11.6: Order EMI to modify the intake such that all streamflow up to 3.4 cfs (2.20 mgd) flows below Diversion 236 on Hoolawanui Stream to provide for recreational uses and downstream habitat.

IMPLEMENTATION

- Staff recognize that the large number of modifications, repairs, and reconfigurations needed to implement these recommendations may take several years to determine the extent of permitting, feasibility of construction, and final installation. Therefore, staff recommend the following modifications be prioritized:

  Modification of C-5 on Ka‘aiea
  Modification of S-13 on ‘O‘opuola
  Modification of C-7 on ‘O‘opuola
  Modification of W-13 on Kailua
  Abandonment of NH-14 on Oanui
  Abandonment of L-8 on Waipi‘o stream
  Modification of H-7 on Ho‘olawa Stream

- Following Commission action, East Maui Irrigation will submit a reasonable timeline to implement the seven priority modifications to Commission staff within 60 days, including likely permitting or jurisdictional requests from other agencies. Following this, additional timelines may be developed for implementation of specific actions associated with the recommendations.

- Following Commission action, East Maui Irrigation will submit a reasonable timeline to implement the other system modifications to Commission staff within 120 days, including likely permitting or jurisdictional requests from other agencies. Following this, additional timelines may be developed for implementation of specific actions associated with the recommendations.
- East Maui Irrigation will submit to Commission staff Stream Diversion Abandonment Permits for the requested abandonments within 60 days.
- Staff shall seek to enforce the provisions of the State Water Code should any unauthorized, non-registered or non-permitted diversions be discovered in the course of its fieldwork.
- Commission staff will coordinate with stakeholders including DHHL, EMI/Mahi Pono, and Maui DWS to develop a water shortage plan to address concerns over a projected shortfall of water for competing public trust uses during drought.

MONITORING

- Staff will work with the East Maui community to verify that these recommendations protect instream uses.
- Staff will monitor streamflow at specific locations as needed to verity that sufficient quantities of water remain in the stream, as expected.
- Staff will implement a long-term continuous monitoring program of groundwater gains and instream flow standards where appropriate.
- It is the responsibility of the diversion operator to maintain the system such that the interim IFS is being met at all times.

EVALUATION

- Staff shall report to the Commission on the progress of implementing the proposed recommendations following the establishment of a timeline associated with the diversion abandonments and modifications.
- Staff shall assess the implementation of these strategies on an as-needed basis, as may be necessary upon consultation with the affected parties.

Ola i ka wai,

M. KALEO MANUEL
Deputy Director

EXHIBITS

Exhibit 1	DHHL land use designations and water use rates
Exhibit 2	DHHL Petition for Reservation of 11,177,500 gallons per day originating from the watershed of, and tributaries to, the East Maui streams diverted by the East Maui Irrigation system for non-potable water use in the Pūlehunui (1,327,500 gallons per day) and Kēōkea-Waiohuli Hawaiian Home Lands (9,850,000 gallons per day). *https://files.hawaii.gov/dlnr/cwrm/activity/dhhl/20201216_DHHL_Pulehunui-Keokea-Waiohuli.pdf*
Exhibit 3	Summary of Current Instream Uses and Stream Diversions in the Huelo Region of East Maui. Briefing to the Commission on Water Resource Management. July 19, 2022. *https://files.hawaii.gov/dlnr/cwrm/submittal/2022/sb20220719B2.pdf*
Exhibit 4	Public Testimony for item B-2. July 19, 2022. *https://files.hawaii.gov/dlnr/cwrm/submittal/2022/sb20220719C1T.pdf*
Exhibit 5	Low-flow characteristics and surface water availability in East Maui, Hawai‘i. PR-2022-01. *https://files.hawaii.gov/dlnr/cwrm/publishedreports/PR202201.pdf*
Exhibit 6	Summary of Current Instream Uses and Stream Diversions in the Huelo Region of East Maui. Briefing to the Commission on Water Resource Management. August 16, 2022. *https://files.hawaii.gov/dlnr/cwrm/submittal/2022/sb20220816C1.pdf*
Exhibit 7	Public Testimony for item C-1. August 16, 2022 *https://files.hawaii.gov/dlnr/cwrm/submittal/2022/sb20220816C1T.pdf*
Exhibit 8	Instream Flow Standard Assessment Report for the hydrologic units of Kōlea, Punalu‘u, Ka‘aiea, ‘O‘opuola, Puehu, Nailiilihaele, Kailua, Hānawana, Hoalua, Waipi‘o, Ho‘olawa. *https://dlnr.hawaii.gov/cwrm/surfacewater/ifs/eastmaui3/*
Exhibit 9	Proposed modifications to EMI diversions on streams in the Huelo area to meet instream uses. September 20, 2022. *https://files.hawaii.gov/dlnr/cwrm/submittal/2022/sb20220920C1.pdf*
Exhibit 10	Diagram of East Maui with irrigation systems, streams, low-flow duration values, and proposed interim IFS locations and values.

APPROVED FOR SUBMITTAL:

Suzanne D. Case

SUZANNE D. CASE
Chairperson

Source: *State of Hawai'i, Department of Hawaiian Home Lands. (2017). State Water Projects Plan Update, Hawai'i Water Plan.*

Table 3.4: SWPP Potable Water Demand Unit Rates by Land Use Designation

DHHL Land Use Designation	Water System Standards Designation	Potable Water Demand Unit Rate (Average Day)			
		Hawai'i	Kaua'i	Maui	O'ahu
Residential	Residential: Single Family or Duplex	400 gal/unit	500 gal/unit	600 gal/unit	500 gal/unit
Subsistence Agriculture	Residential: Single Family or Duplex	400 gal/unit	500 gal/unit	600 gal/unit	500 gal/unit
Supplemental Agriculture	N/A	None	None	None	None
Pastoral	Residential: Single Family or Duplex	400 gal/unit	500 gal/unit	600 gal/unit	500 gal/unit
General Agriculture	N/A	None	None	None	None
Special District	Varies	Varies	Varies	Varies	Varies
Community Use	Schools, Parks	4,000 gal/acre or 60 gal/student	4,000 gal/acre or 60 gal/student	1,700 gal/acre or 60 gal/student	4,000 gal/acre or 60 gal/student
Conservation	N/A	None	None	None	None
Commercial	Commercial Only Commercial-Industrial Mix	3,000 gal/acre 140 gal/1,000 SF	3,000 gal/acre 140 gal/1,000 SF	3,000 gal/acre 140 gal/1,000 SF	3,000 gal/acre 140 gal/1,000 SF
Industrial	Light Industry	4,000 gal/acre	4,000 gal/acre	6,000 gal/acre	4,000 gal/acre

EXHIBIT 1

Source: *State of Hawai'i, Department of Hawaiian Home Lands. (2017). State Water Projects Plan Update, Hawai'i Water Plan.*

Table 3.5: SWPP Non-Potable Water Demand Unit Rates by Land Use Designation

DHHL Land Use Designation	Non-Potable Water Demand Unit Rate (Average Day)			
	Hawai'i	Kaua'i	Maui	O'ahu
Residential	None	None	None	None
Subsistence Agriculture	3,400 gal/acre	3,400 gal/acre	3,400 gal/acre	3,400 gal/acre
Supplemental Agriculture	3,400 gal/acre	3,400 gal/acre	3,400 gal/acre	3,400 gal/acre
Pastoral	20 gal/acre	20 gal/acre	20 gal/acre	20 gal/acre
General Agriculture	3,400 gal/acre	3,400 gal/acre	3,400 gal/acre	3,400 gal/acre
Special District	Varies	Varies	Varies	Varies
Community Use	None	None	None	None
Conservation	None	None	None	None
Commercial	None	None	None	None
Industrial	None	None	None	None

Note: In areas to be developed as Lo'i Kalo, non-potable water demand unit rate 150,000 gal/acre/day superseded unit rate in Table 3.5.

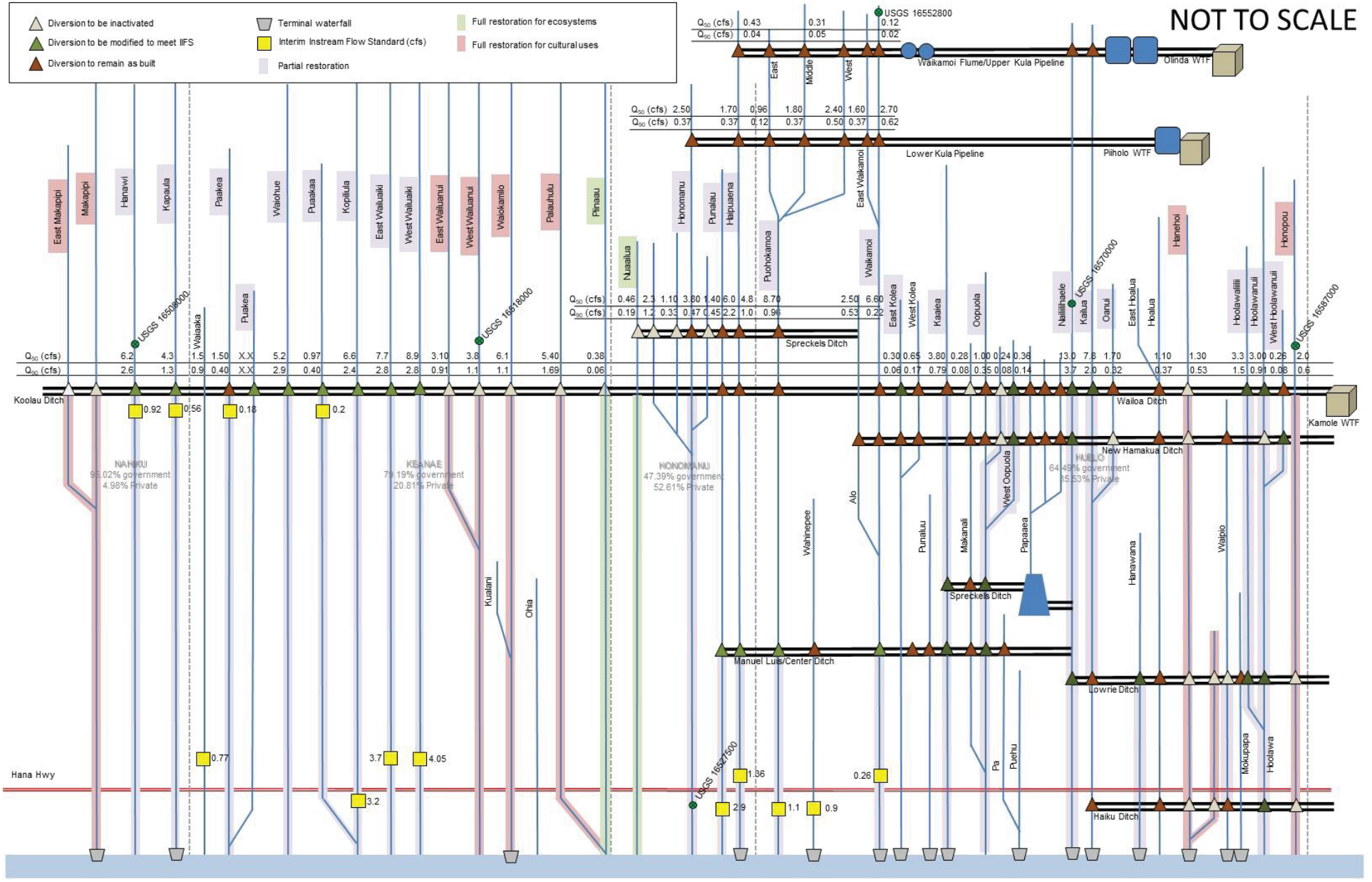

Diversion to be inactivated
Diversion to be modified to meet IIFS
Diversion to remain as built
Terminal waterfall
Interim Instream Flow Standard (cfs)
Partial restoration
Full restoration for ecosystems
Full restoration for cultural uses
NOT TO SCALE
USGS 16552800
Waikamoi Flume/Upper Kula Pipeline
Olinda WTF
Lower Kula Pipeline
Piiholo WTF
Spreckels Ditch
Koolau Ditch
Wailoa Ditch
New Hamakua Ditch
Kamole WTF
Manuel Luis/Center Ditch
Lowrie Ditch
Haiku Ditch
Hana Hwy
NAHIKU
93.02% government
4.98% Private
KEANAE
79.19% government
20.81% Private
HONOMANU
47.39% government
52.61% Private
HUELO
64.49% government
35.53% Private
East Makapipi
Makapipi
Hanawi
Kapaula
Waiaaka
Paakea
Puakea
Waiohue
Puaakaa
Kopiliula
East Wailuaiki
West Wailuaiki
East Wailuanui
West Wailuanui
Waiokamilo
Palauhulu
Piinaau
Nuaailua
Honomanu
Punalau
Haipuaena
Puohokamoa
East Waikamoi
Waikamoi
East Kolea
West Kolea
Kaalea
Oopuola
Nailiilihaele
Kailua
Oanui
East Hoalua
Hoalua
Hanehoi
Hoolawaliiii
Hoolawanuii
West Hoolawanuii
Honopou
Alo
West Oopuola
Punaluu
Makanali
Papaaea
Wahinepee
Hanawana
Waipio
Kualani
Ohia
Pa
Puehu
Mokupapa
Hoolawa
USGS 16508000
USGS 16618000
USGS 16570000
USGS 16587000
USGS 16527500
0.92
0.56
0.18
0.2
0.77
3.7
4.05
3.2
1.36
2.9
1.1
0.9
0.26

EXHIBIT 10