

Update on Implementation of Waimea Watershed Agreement, Kaua'i

April 16, 2024

Ayron M. Strauch, Hydrologist
Stream Protection and Management Branch



159°44'0"W

159°40'0"W

159°36'0"W

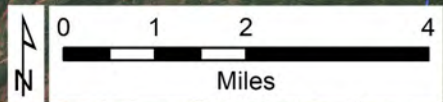
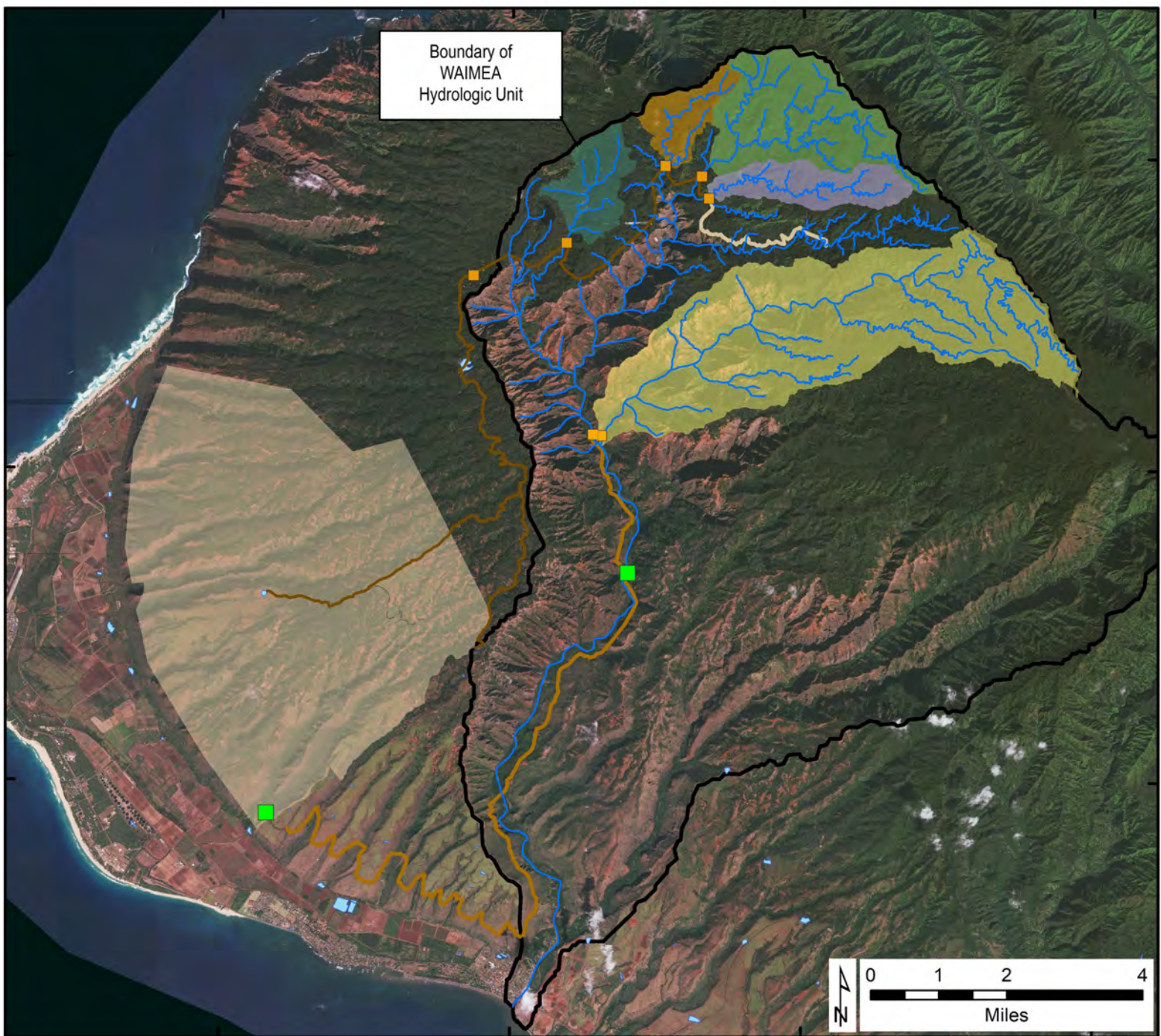
159°32'0"W

Boundary of
WAIMEA
Hydrologic Unit

22°8'0"N

22°4'0"N

22°0'0"N

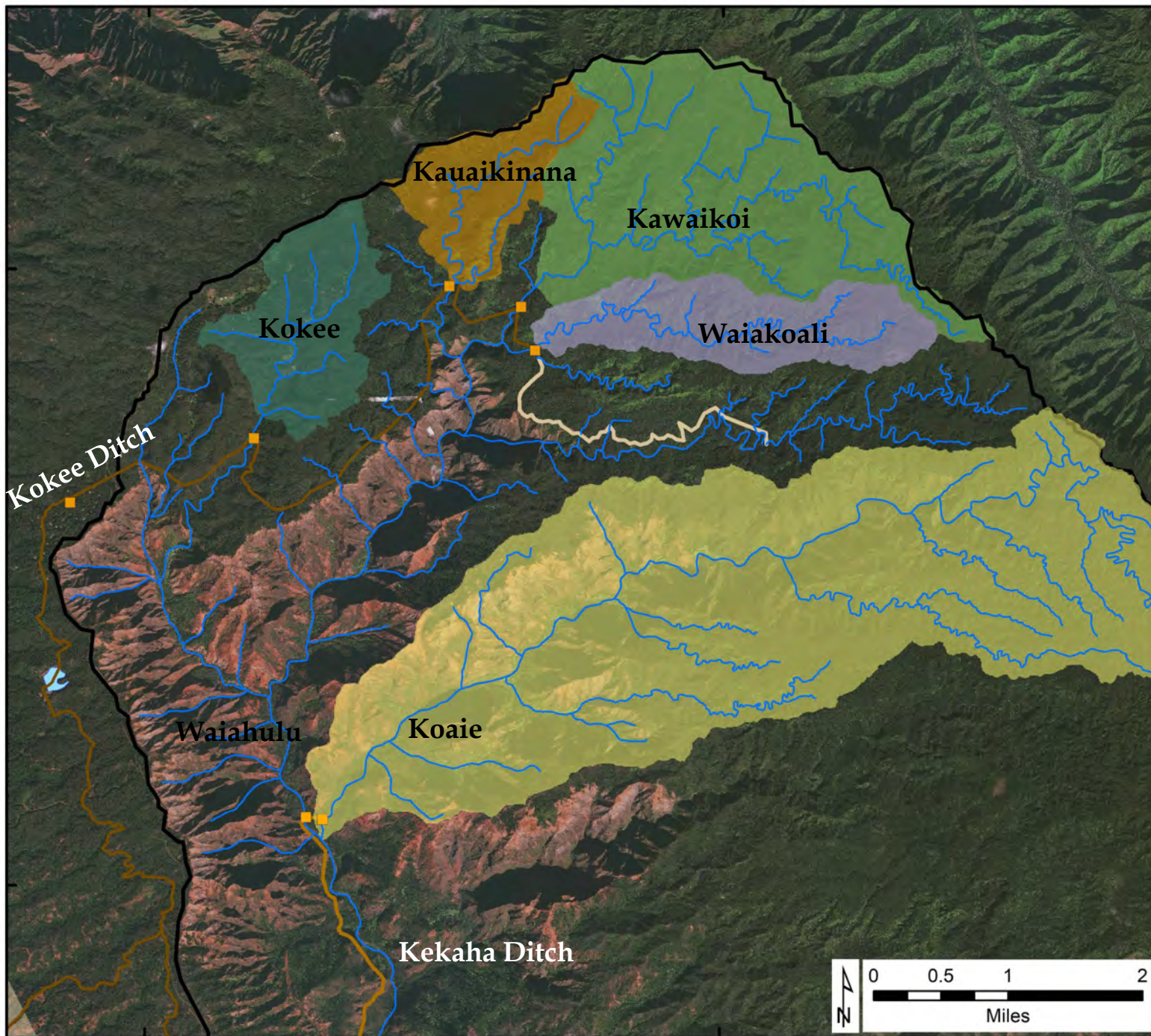


159°40'0"W

159°36'0"W

22°8'0"N

22°4'0"N



Kauaikinana

Kawaikoi

Kohee

Waiakoali

Kohee Ditch

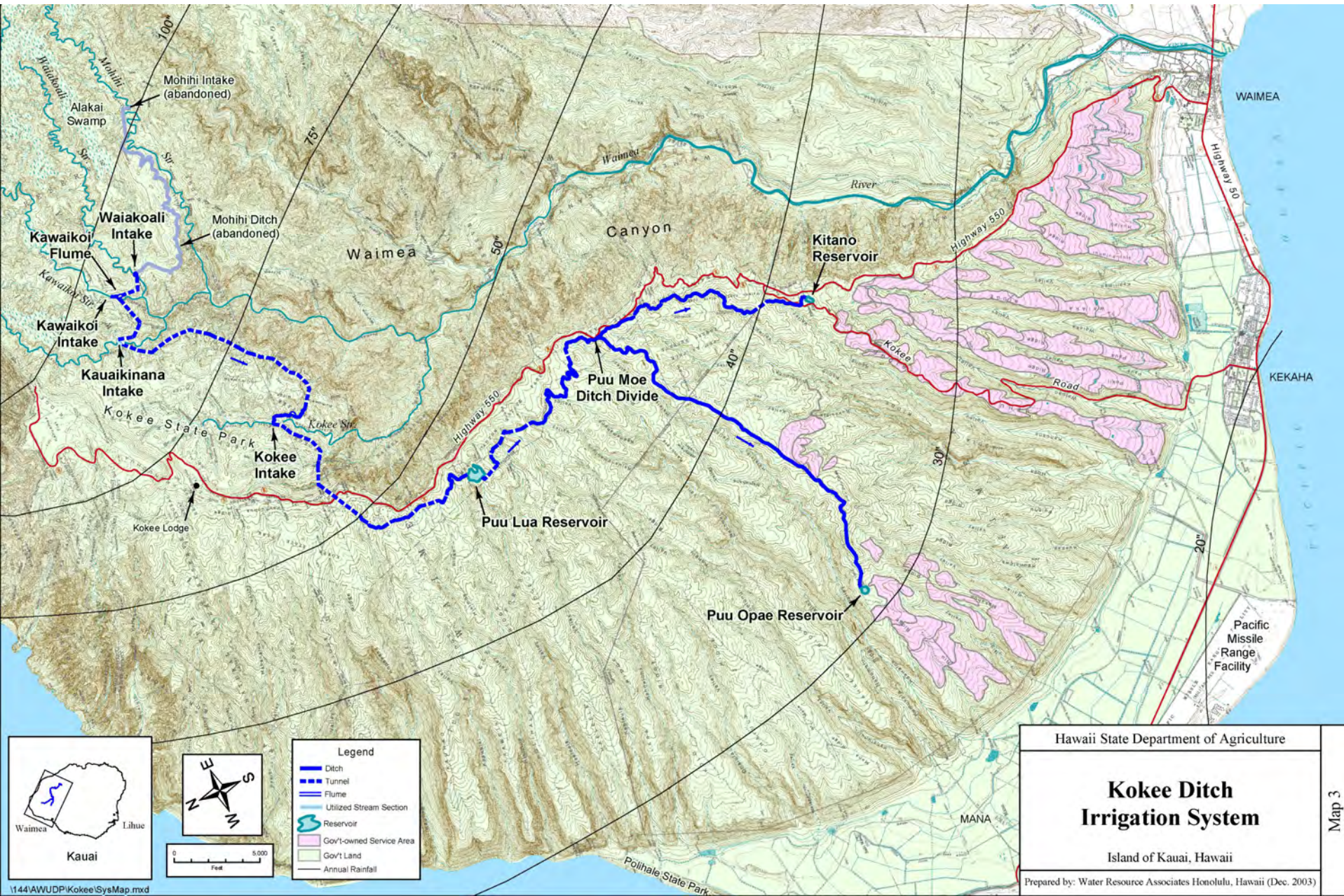
Waiahulu

Koaie

Kekaha Ditch



Kokee Ditch

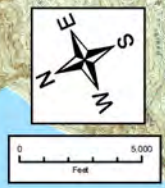
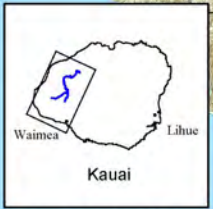


Hawaii State Department of Agriculture

Kokee Ditch Irrigation System

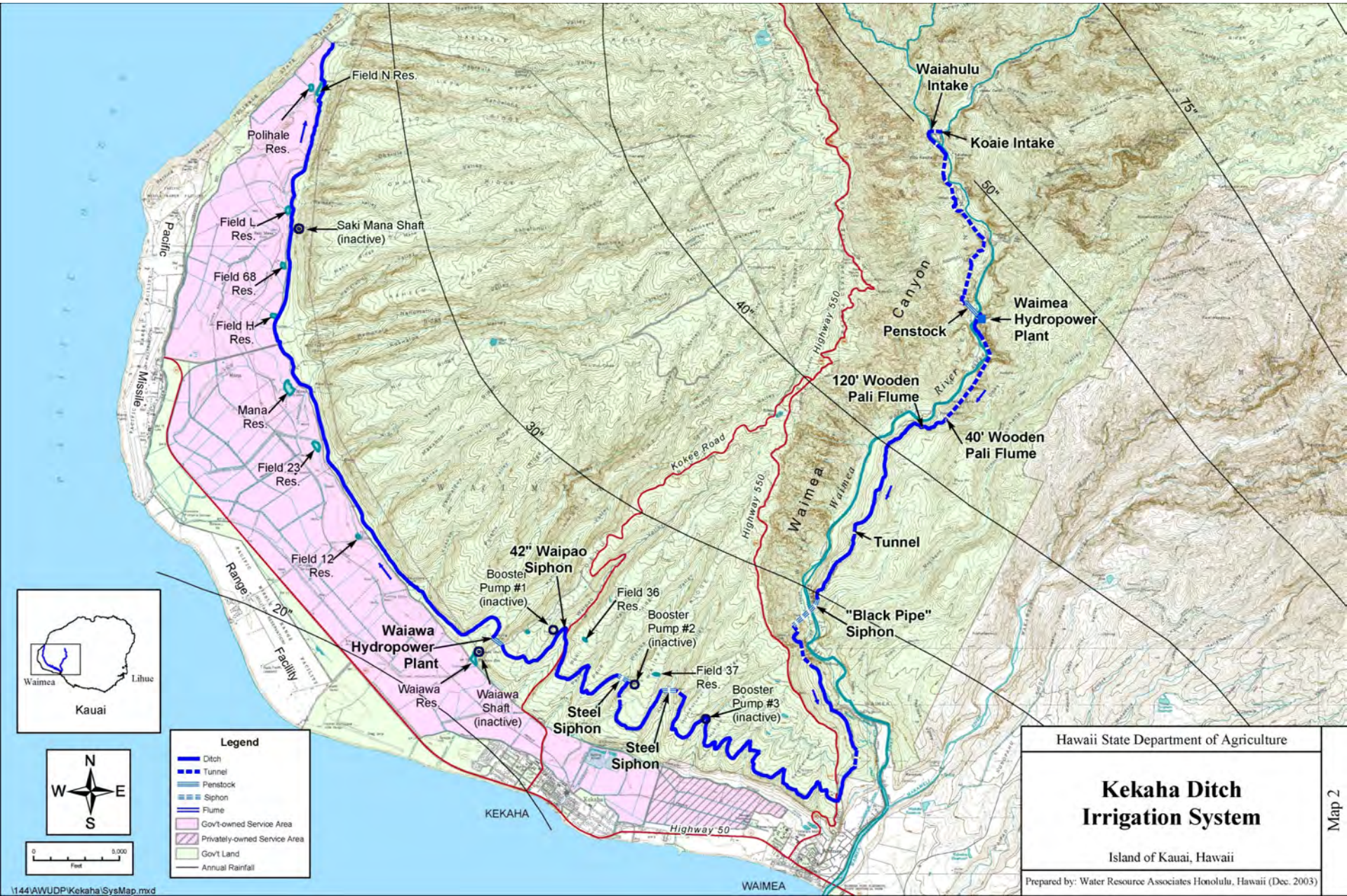
Island of Kauai, Hawaii

Prepared by: Water Resource Associates Honolulu, Hawaii (Dec. 2003)

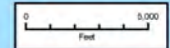
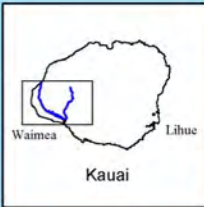


\\144\AWUDP\Kokee\SysMap.mxd

Kekaha Ditch



Kekaha Ditch



Legend

- Ditch
- - - Tunnel
- = Penstock
- Siphon
- Flume
- Gov't-owned Service Area
- Privately-owned Service Area
- Gov't Land
- Annual Rainfall

Hawaii State Department of Agriculture

Kekaha Ditch Irrigation System

Island of Kauai, Hawaii

Prepared by: Water Resource Associates Honolulu, Hawaii (Dec. 2003)

Generalized Timeline Leading to Agreement

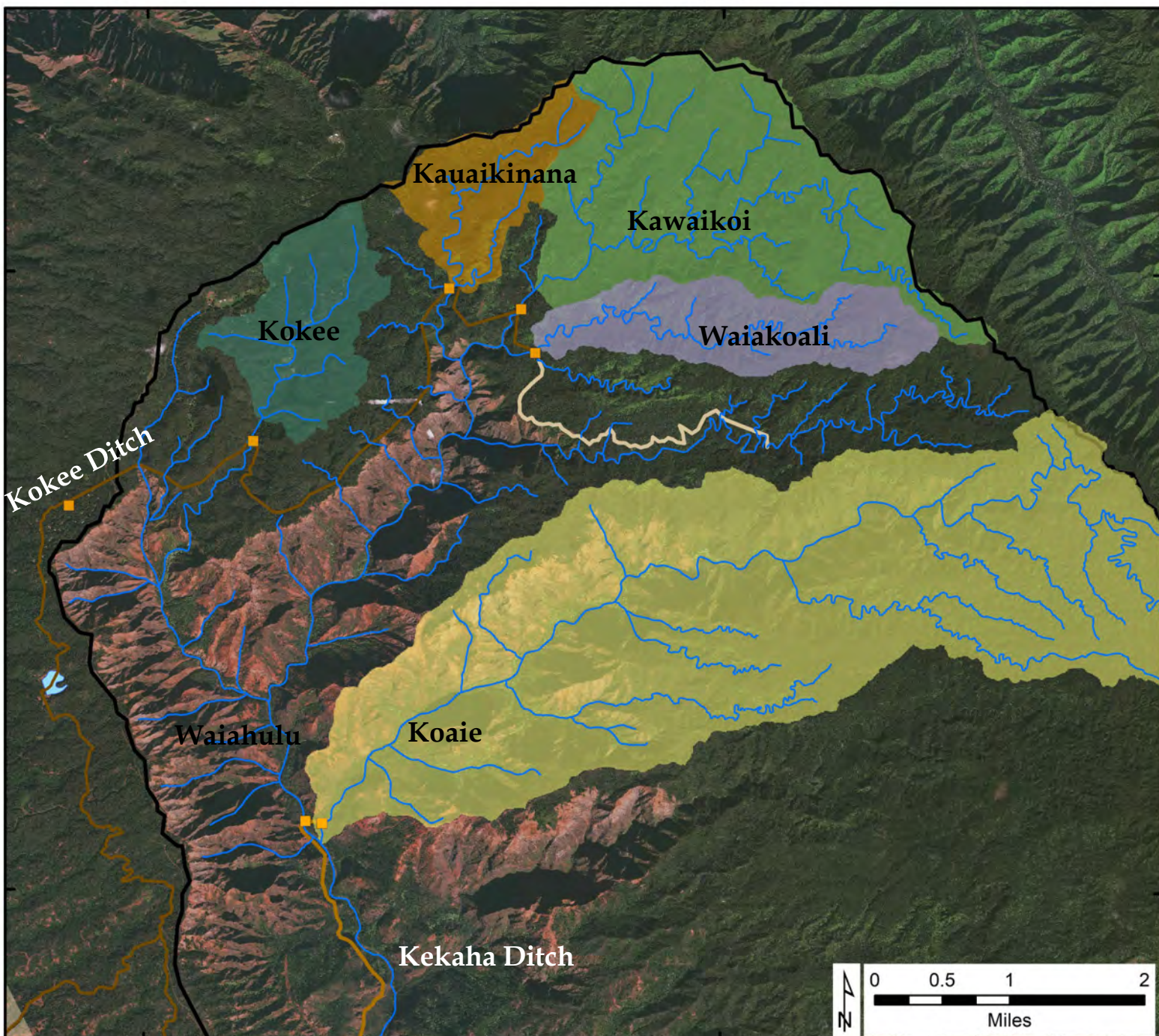
- 2000 Closure of Kekaha Sugar Mill and plantation operations
- 2013 Pō'ai Wai Ola/West Kaua'i Watershed Alliance filed petition to amend instream flow standards and Declaratory Order Against Waste
- 2014 Commission hires consultant and staff begin to conduct fact-gathering
- 2015 Parties agreed to mediation and Commission approved a mediator
- 2016 Parties agreed to accept the estimated annual and seasonal flow values generated by KAA's consultant
- 2017 Parties agreed to accept a two phased approach to interim IFS amendments pending the implementation of KIUC's combined hydro-pumped storage project
- 2017 Waimea Watershed Agreement signed by all parties

159°40'0"W

159°36'0"W

22°8'0"N

22°4'0"N



Kauaikinana

Kawaikoi

Kohee

Waiakoali

Kohee Ditch

Waiahulu

Koaie

Kekaha Ditch



Kokee Ditch- Waiakoali Stream Diversion





Kokee Ditch- Kawaikoi Stream Diversion



Kokee Ditch- Kawaikoi Stream Diversion



Kokee Ditch- Kawaikoi Stream Diversion



Kōke'e Ditch below Kawaikoi Stream Intake



Kōke'e Ditch below Kawaikoi Stream Intake



Kokee Ditch- Kauaikinana Stream Diversion



Kokee Ditch- Kauaikinana Stream Diversion



Kokee Ditch- Kokee Stream Diversion



Kokee Ditch- Kauaikinana Stream Diversion



Kokee Ditch- Puu Lua Reservoir



Kokee Ditch- Puu Moi Divide



Kokee Ditch- Puu Moi Divide towards DHHL



Kokee Ditch- towards ADC



Kekaha Ditch- Koaie Stream Diversion



Kekaha Ditch- Koaie Stream return



Kekaha Ditch- Waiahulu Stream Diversion



Kekaha Ditch- Waiahulu Stream Diversion



Kekaha Ditch- Waiahulu Stream Diversion



Kekaha Ditch- Waiahulu Stream return



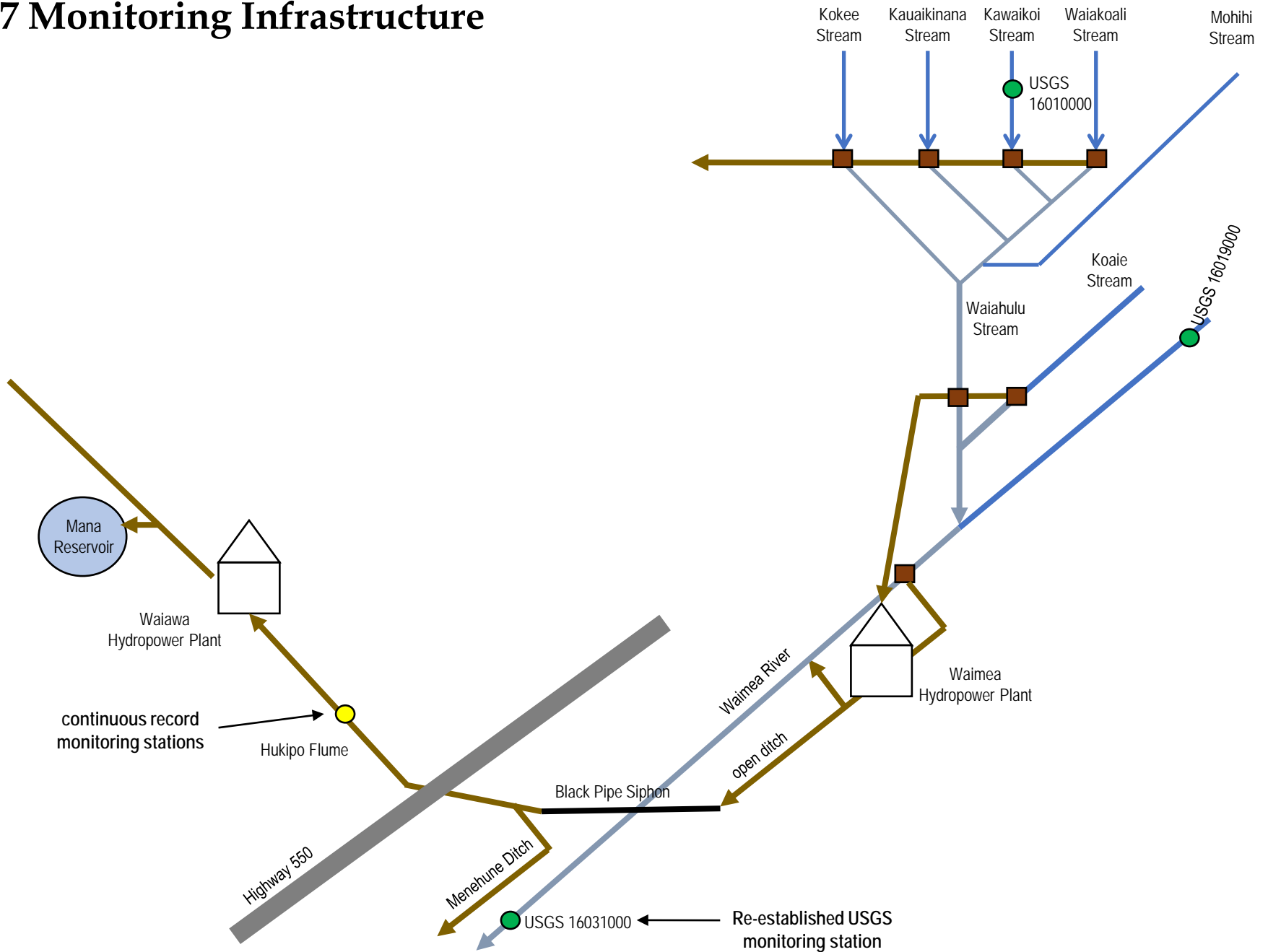
Kekaha Ditch- below Waiahulu Stream Diversion



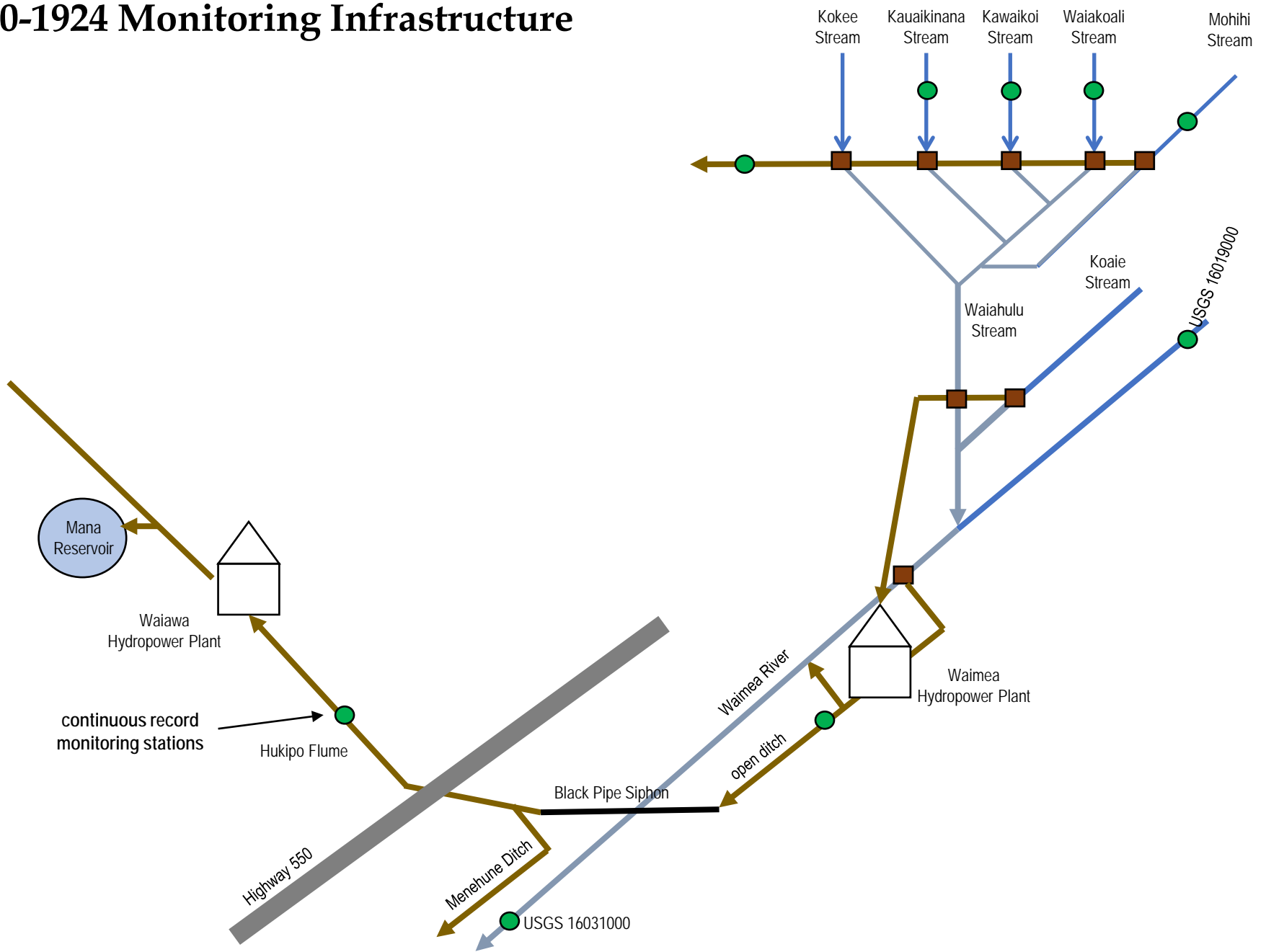
Kekaha Ditch- Mauka Hydropower Plant



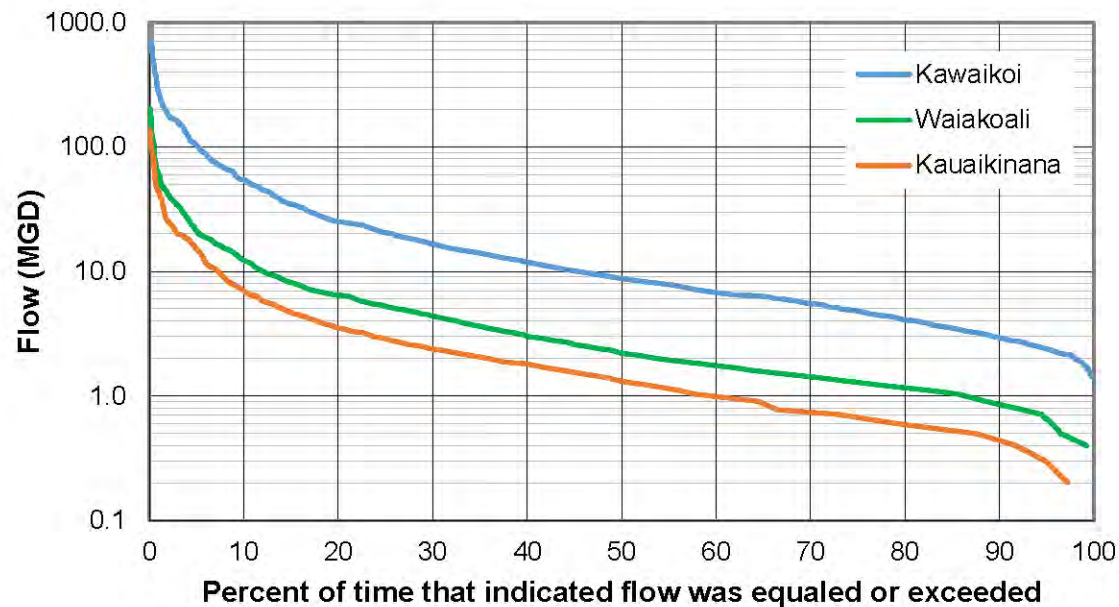
2017 Monitoring Infrastructure



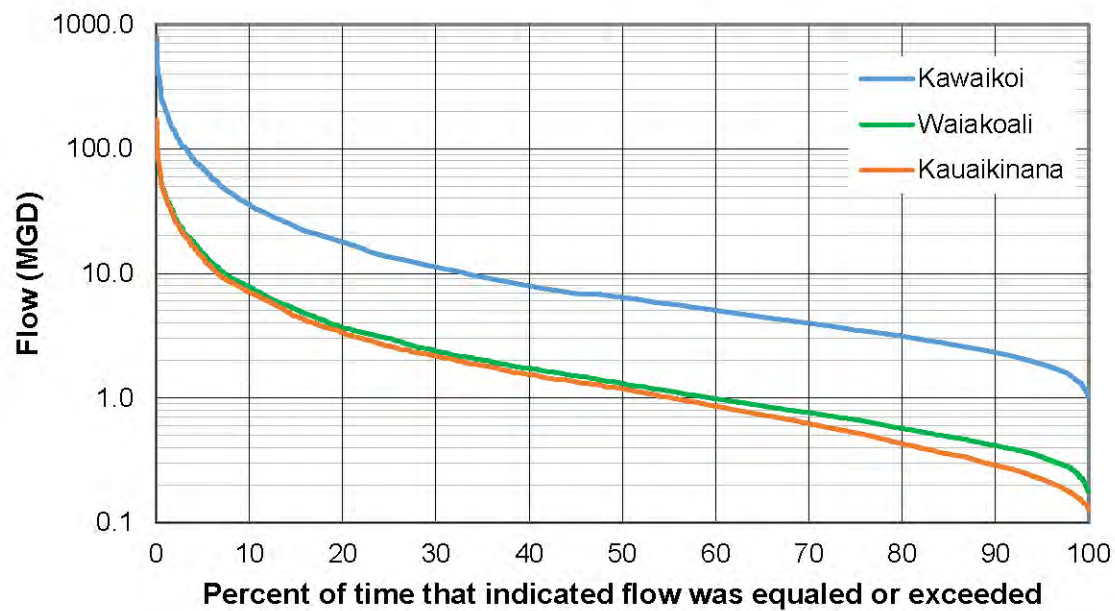
1920-1924 Monitoring Infrastructure



- Similar form suggests all three streams have a like response to storm rainfall and an equivalent dependence on baseflow fed by outflow from the Alaka'i Swamp and other shallow, high-elevation groundwater sources



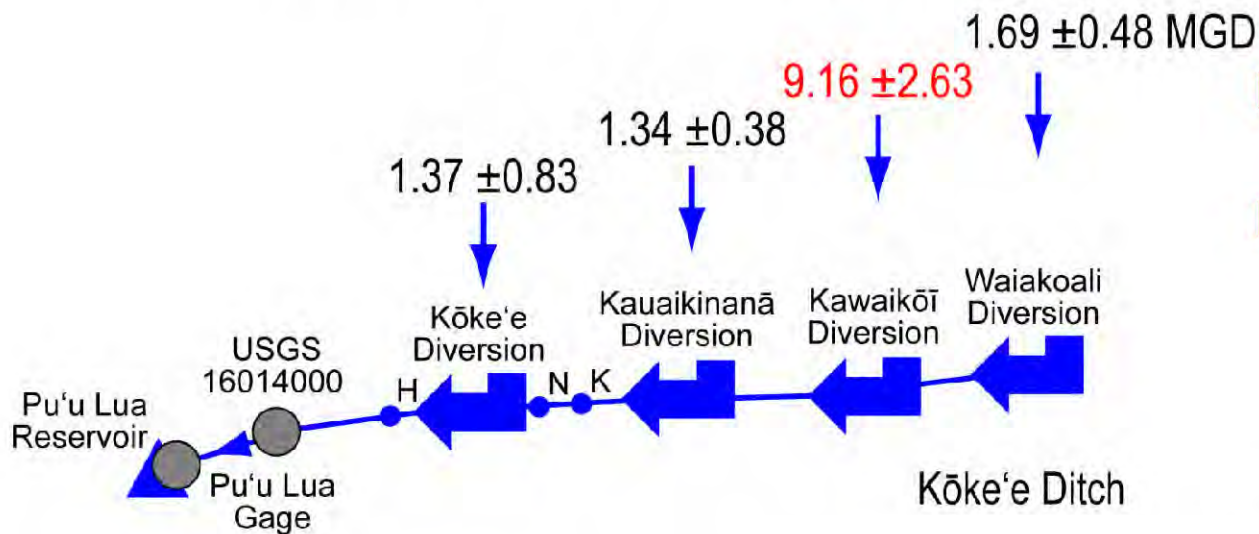
Flow duration curves for Kawaikōī, Waiakoali and Kauauikinā streams derived from gaging records for the calendar years 1920 through 1924.



Kawaikōī, Waiakoali and Kauaikinā streams simulated flow duration curves for the period 2006 through 2014.

2006-2014 Estimated Summer Water Availability at Kokee Ditch Diversions

Amounts of water available (MJJASO)



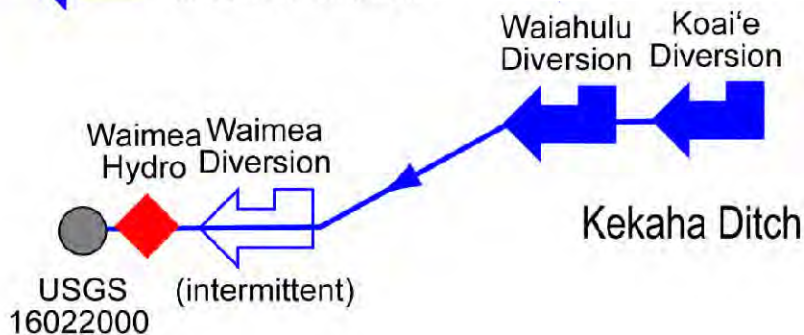
- ❑ *monthly discrepancy ratios*
- ❑ *only last 2 decades of record (1978-97) used to adjust for reduction in ditch flow due to abandonment of Mohihi Diversion*

● Active ephemeral stream diversions

K = Kumuela 1 - 5

N = Nawaimaka

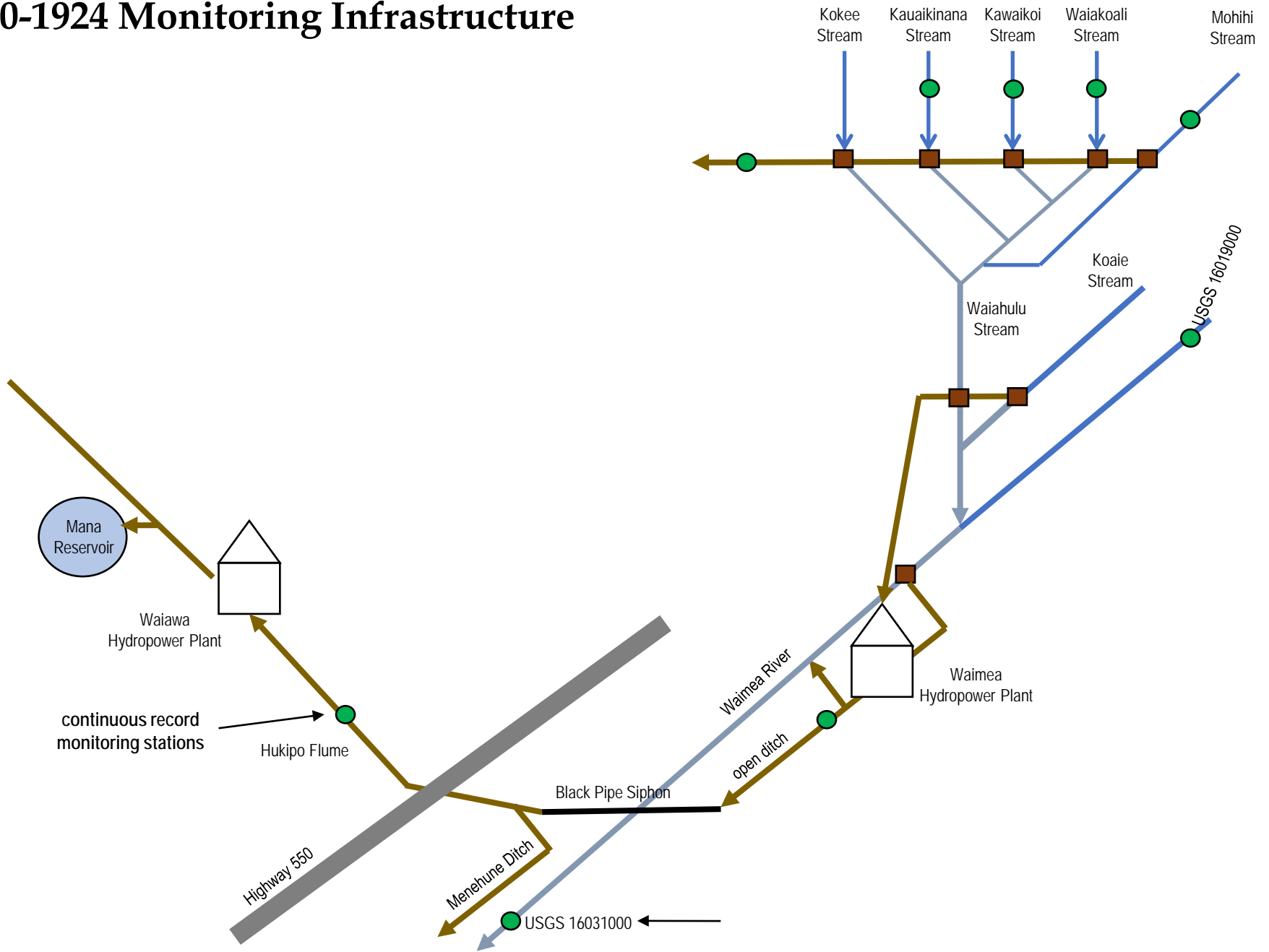
H = Halemanu



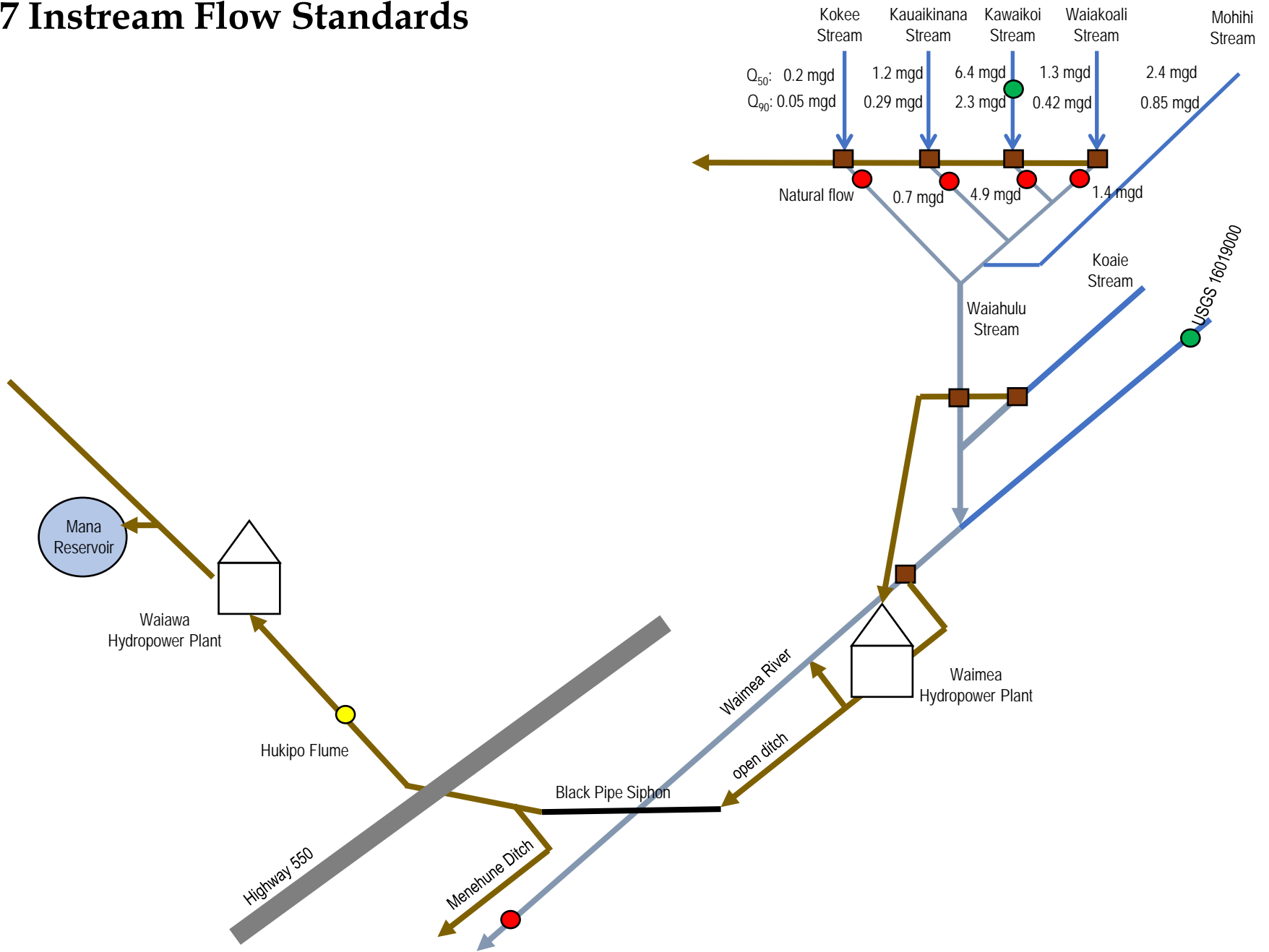
2006-2014 Estimated Water Availability at Kokee Ditch Diversions Accepted for the Waimea Watershed Agreement

Stream	Summer (MGD)	Q50 (MGD)	Q70 (MGD)	Q90 (MGD)	E2 (MGD)	KIUC (MGD)
Waiakoali	1.69 ±0.48	1.31	0.76	0.42	2.13	2.00
Kawaikōi	9.16 ±2.63	6.43	3.99	2.30	7.76	7.76
Kauauikinanā	1.34 ±0.38	1.19	0.62	0.29	1.29	1.29

1920-1924 Monitoring Infrastructure



2017 Instream Flow Standards



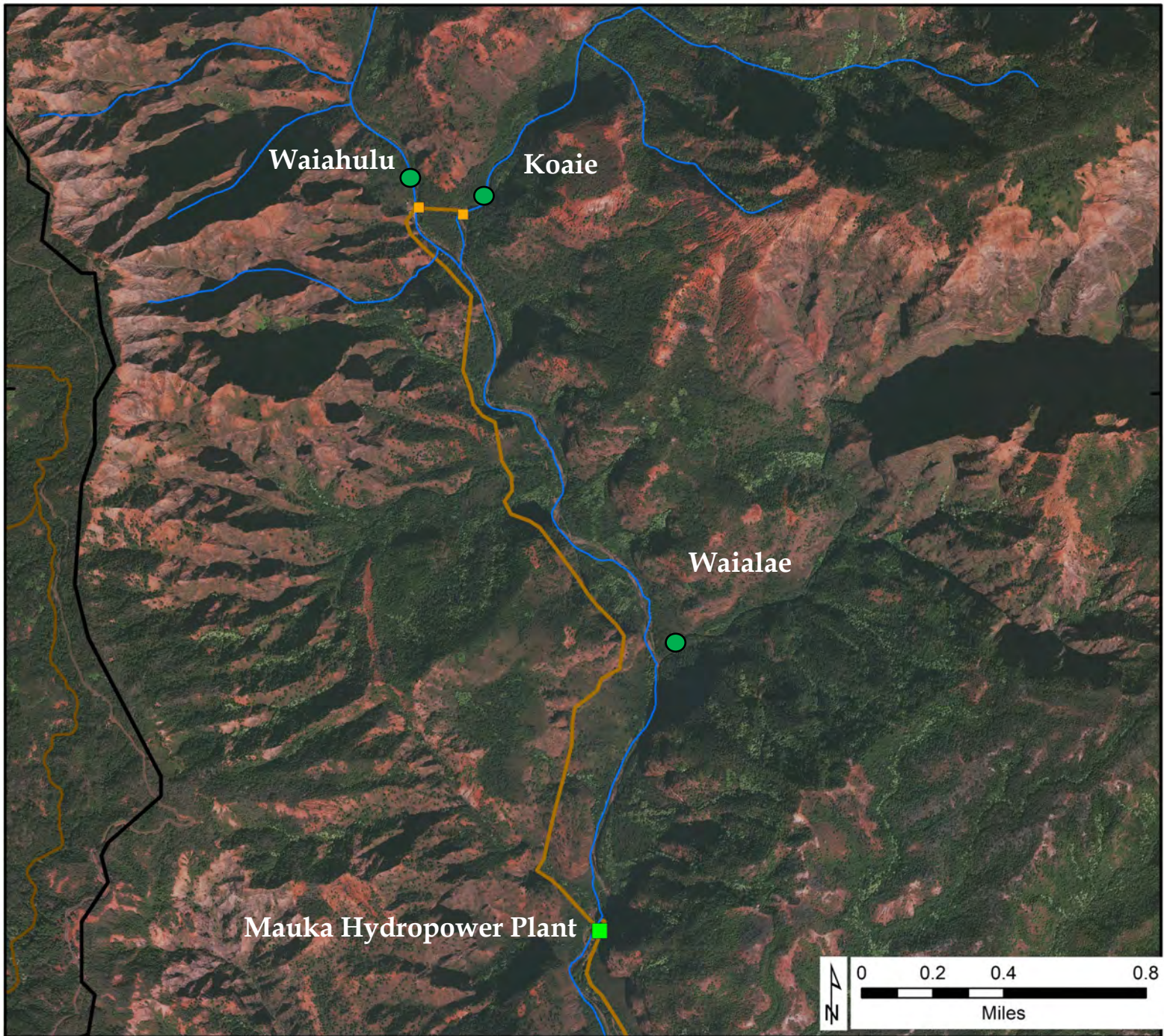
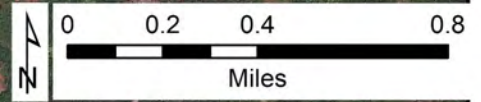
22°40'N

Waiahulu

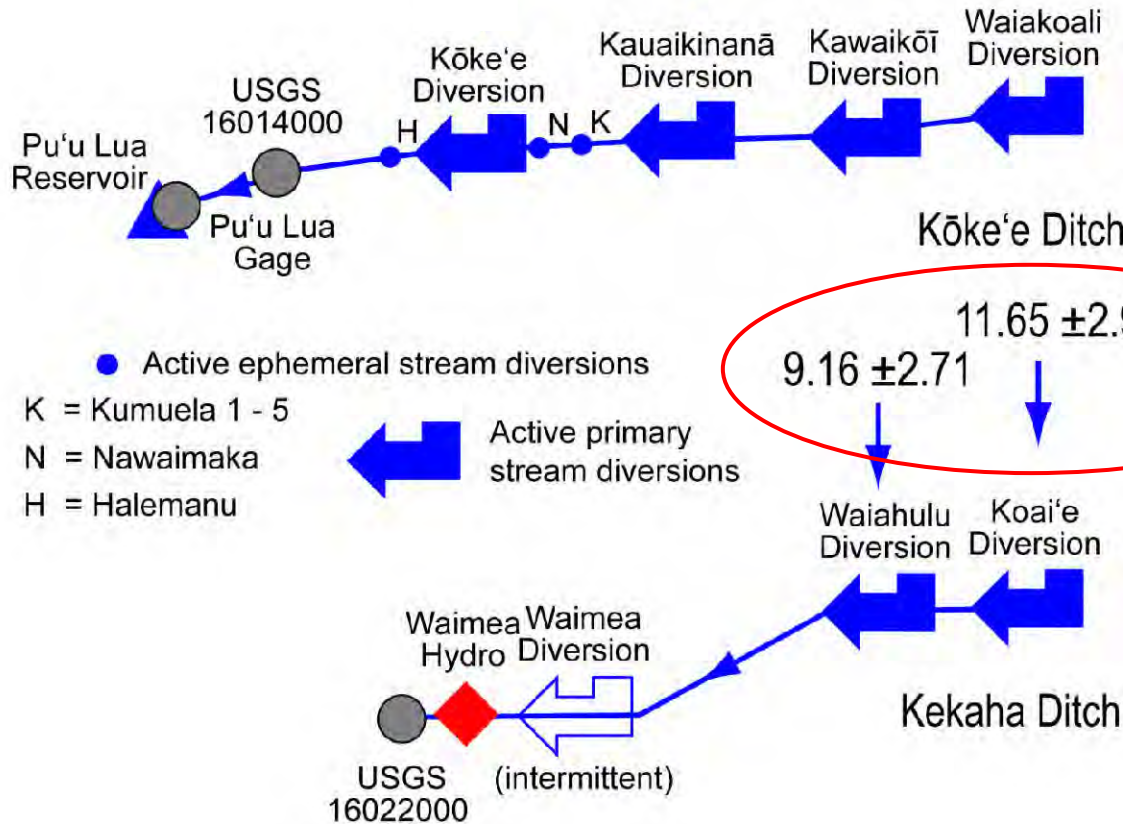
Koaie

Waialae

Mauka Hydropower Plant



Amounts of water available (MJJASO)



9.16 ± 2.71
 11.65 ± 2.99 MGD

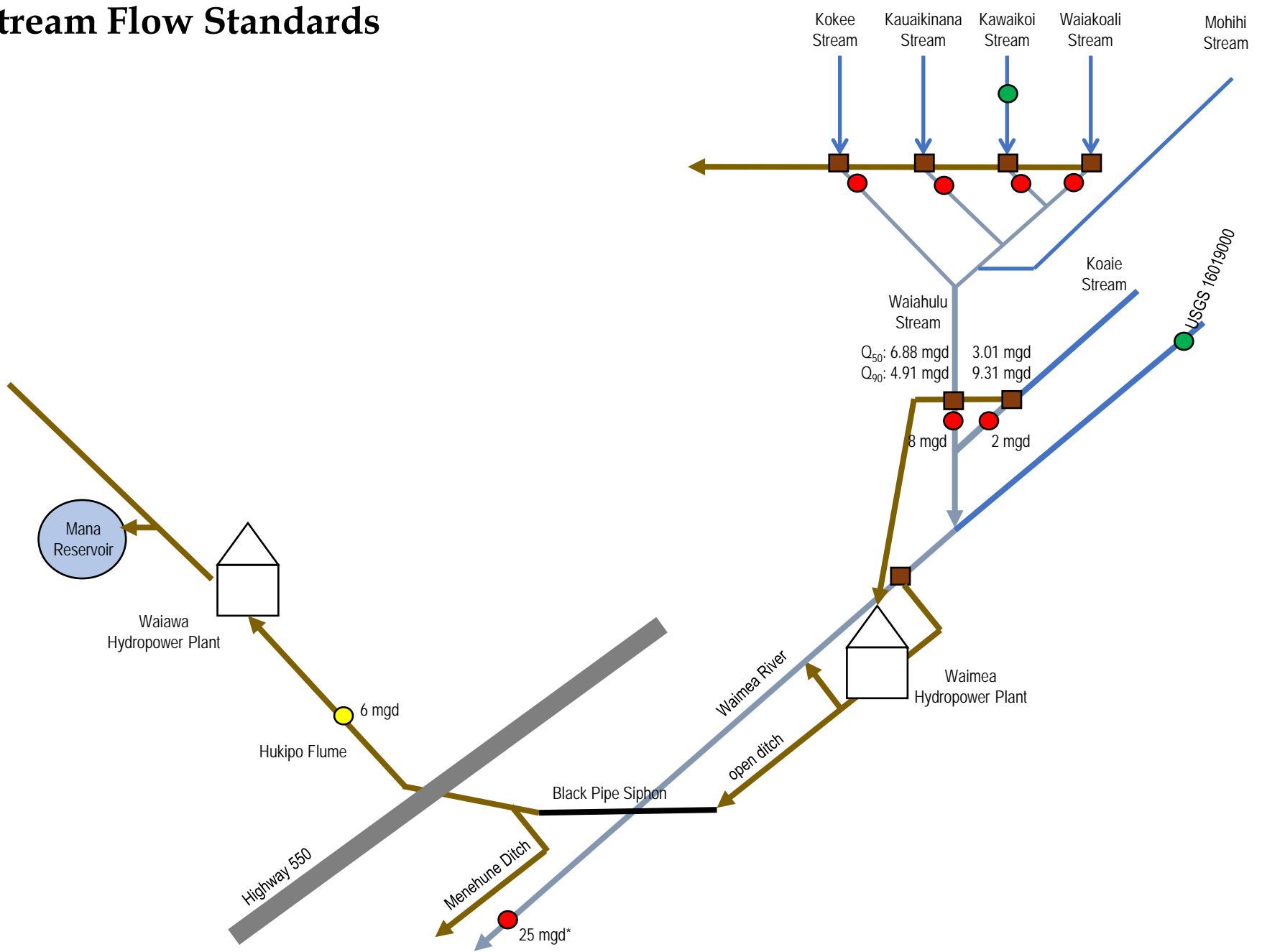
- ❑ *monthly discrepancy ratios*
- ❑ *only last 2 decades of record (1978-97) used to adjust for reduction in ditch flow due to abandonment of Mohihi Diversion*

2006-2014 Estimated Water Availability at Kekaha Ditch Diversions Accepted for the Waimea Watershed Agreement

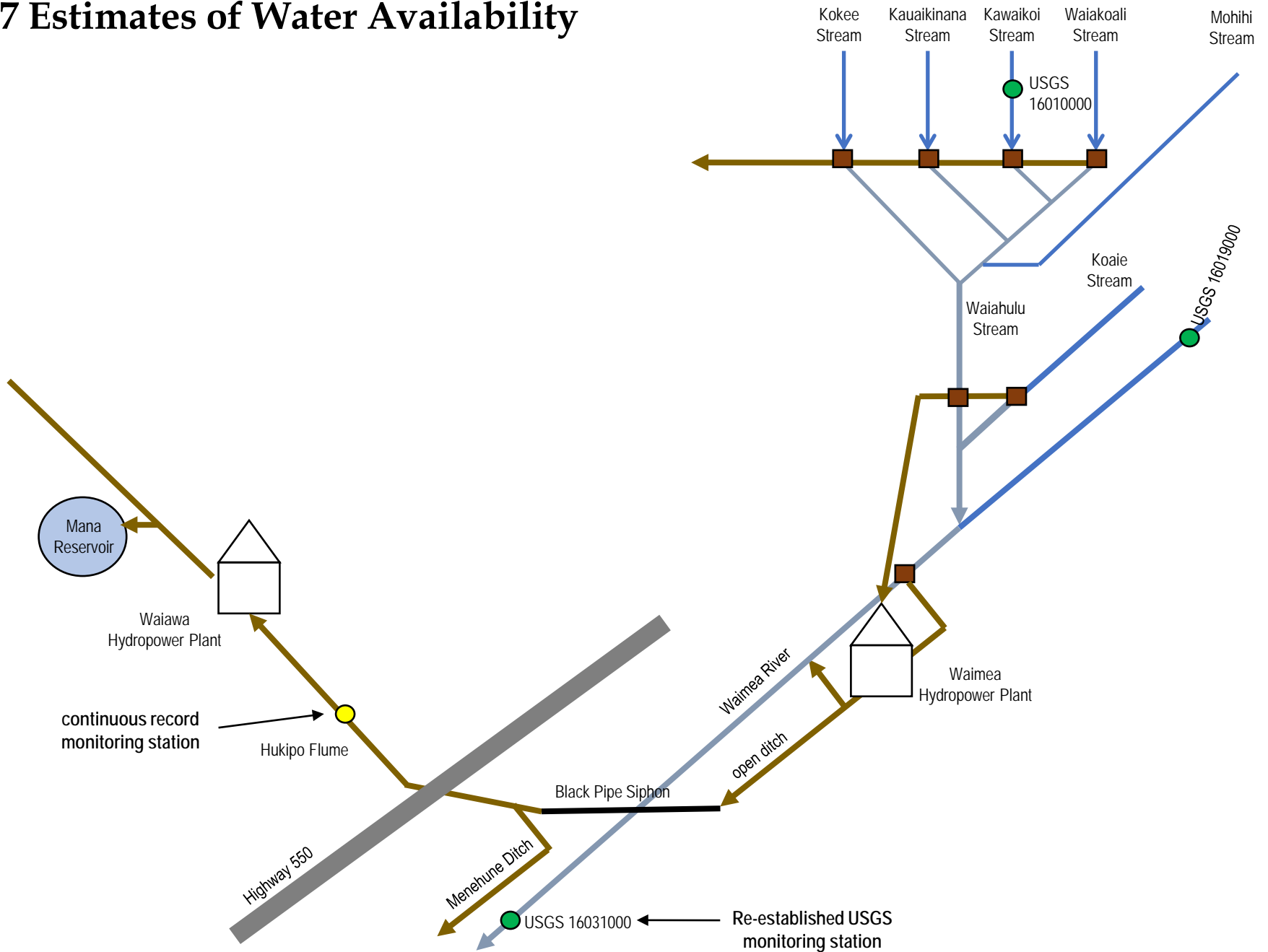
	Summer Flow (mgd)	Q50 (mgd)	Q70 (mgd)	Q90 (mgd)
Waiahulu*	7.18 (±1.84)	6.88	5.90	4.91
Koaie	16.63 (±3.50)	13.07	11.19	9.31

*diverted upstream by Kokee Ditch

Instream Flow Standards



2017 Estimates of Water Availability



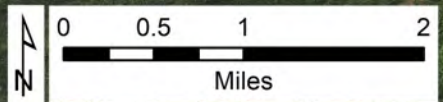
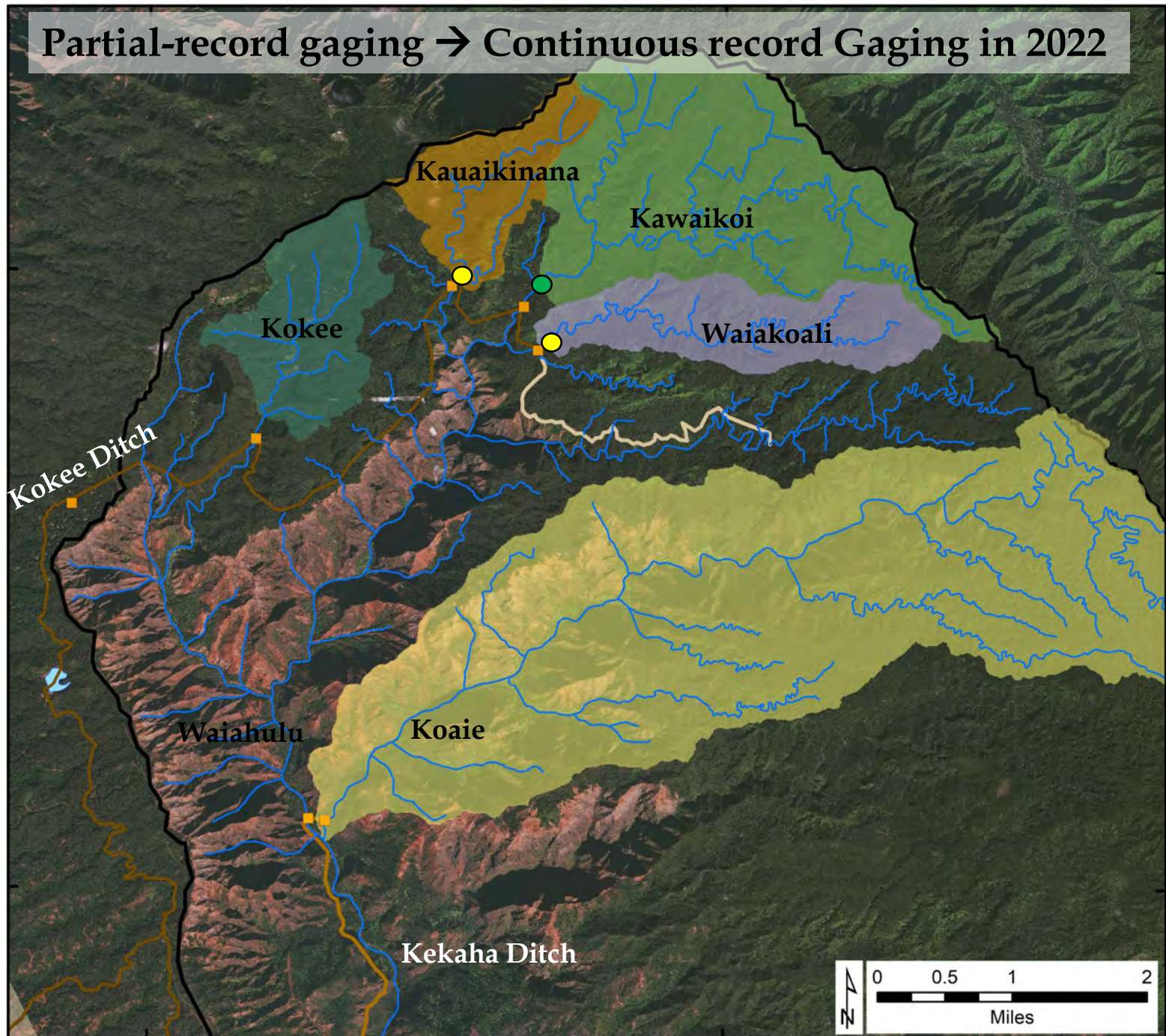
159°40'0"W

159°36'0"W

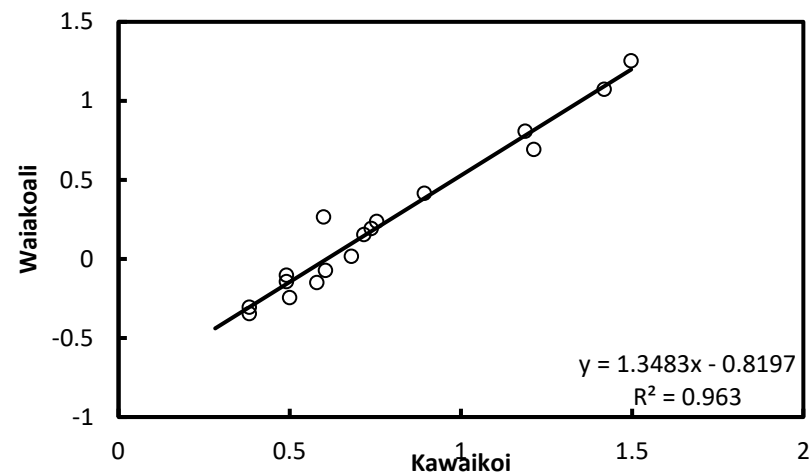
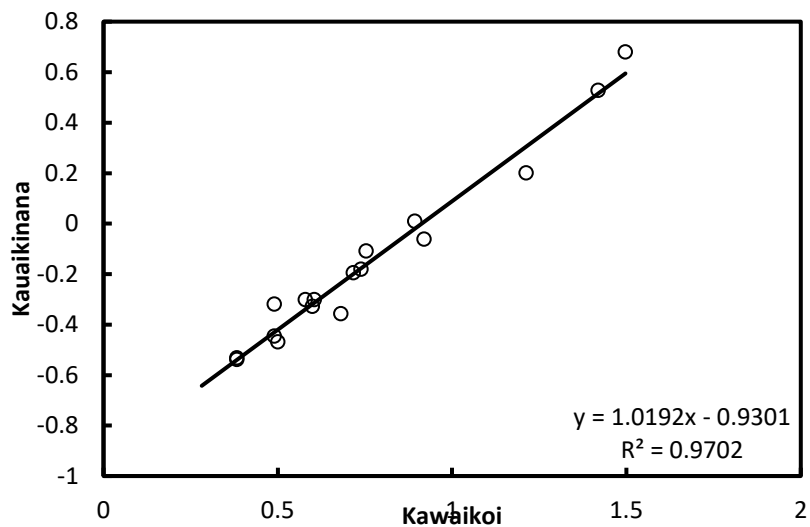
Partial-record gaging → Continuous record Gaging in 2022

22°8'0"N

22°4'0"N



Partial-record gaging → Continuous record Gaging in 2022



2006-2014 Estimated Water Availability at Kokee Ditch Diversions Accepted for the Waimea Watershed Agreement

Stream	Summer (MGD)	Q50 (MGD)	Q70 (MGD)	Q90 (MGD)	E2 (MGD)	KIUC (MGD)
Waiakoali	1.69 ±0.48	1.31	0.76	0.42	2.13	2.00
Kawaikōi	9.16 ±2.63	6.43	3.99	2.30	7.76	7.76
Kauauikinana	1.34 ±0.38	1.19	0.62	0.29	1.29	1.29

2004-2023 Estimated Water Availability at Kokee Ditch Diversions Based on Partial-Record Gaging

	Q50 (mgd)	Q70 (mgd)	Q90 (mgd)	Q95 (mgd)
Waiakoali*	2.39	1.21	0.84	0.61
Kawaikoi	6.79	4.16	3.62	1.85
Kauaikinana*	0.84	0.51	0.28	0.22

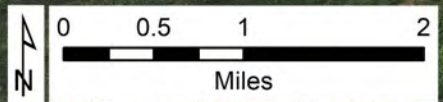
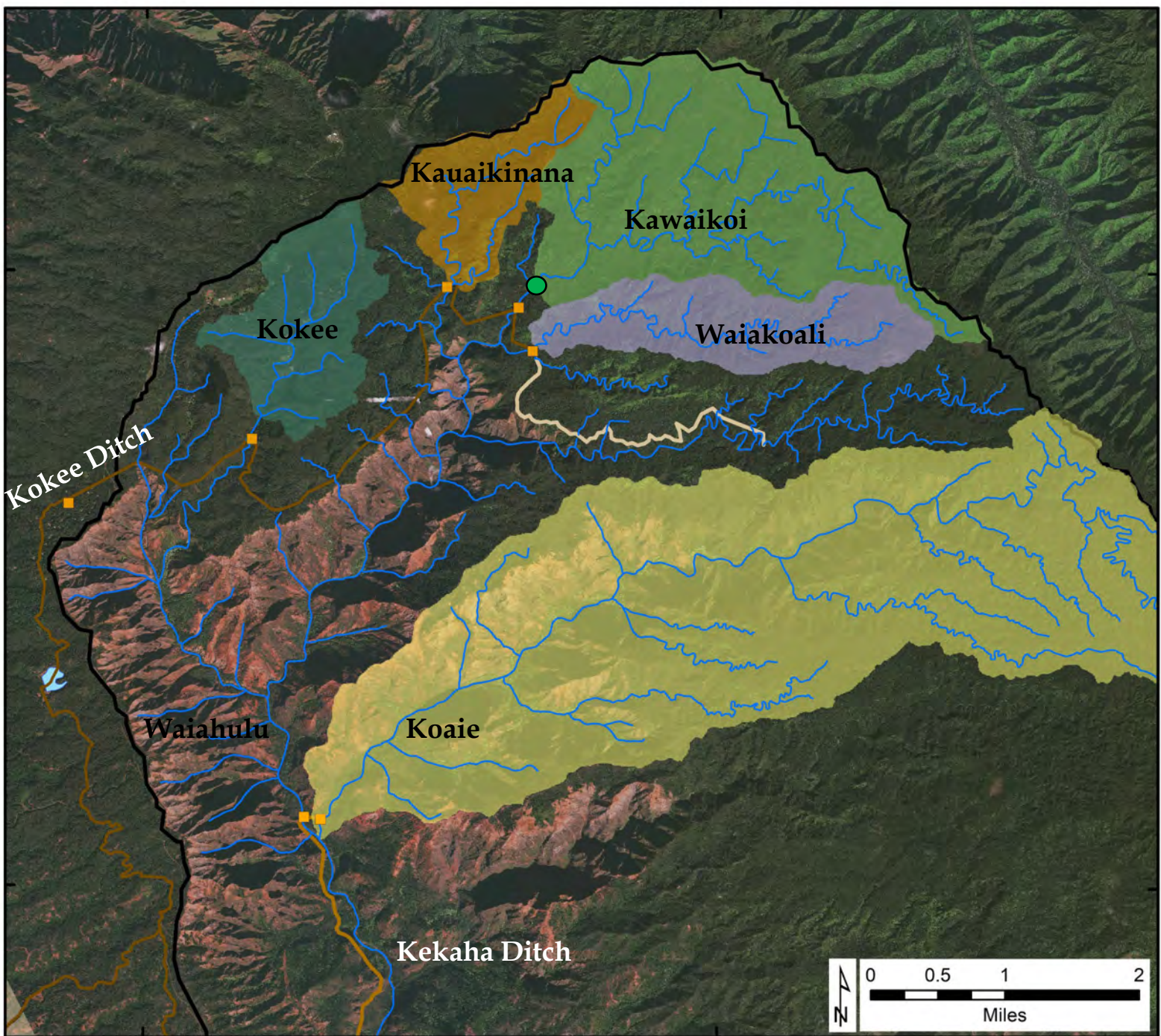
*Using 18 low-flow measurements

159°40'0"W

159°36'0"W

22°8'0"N

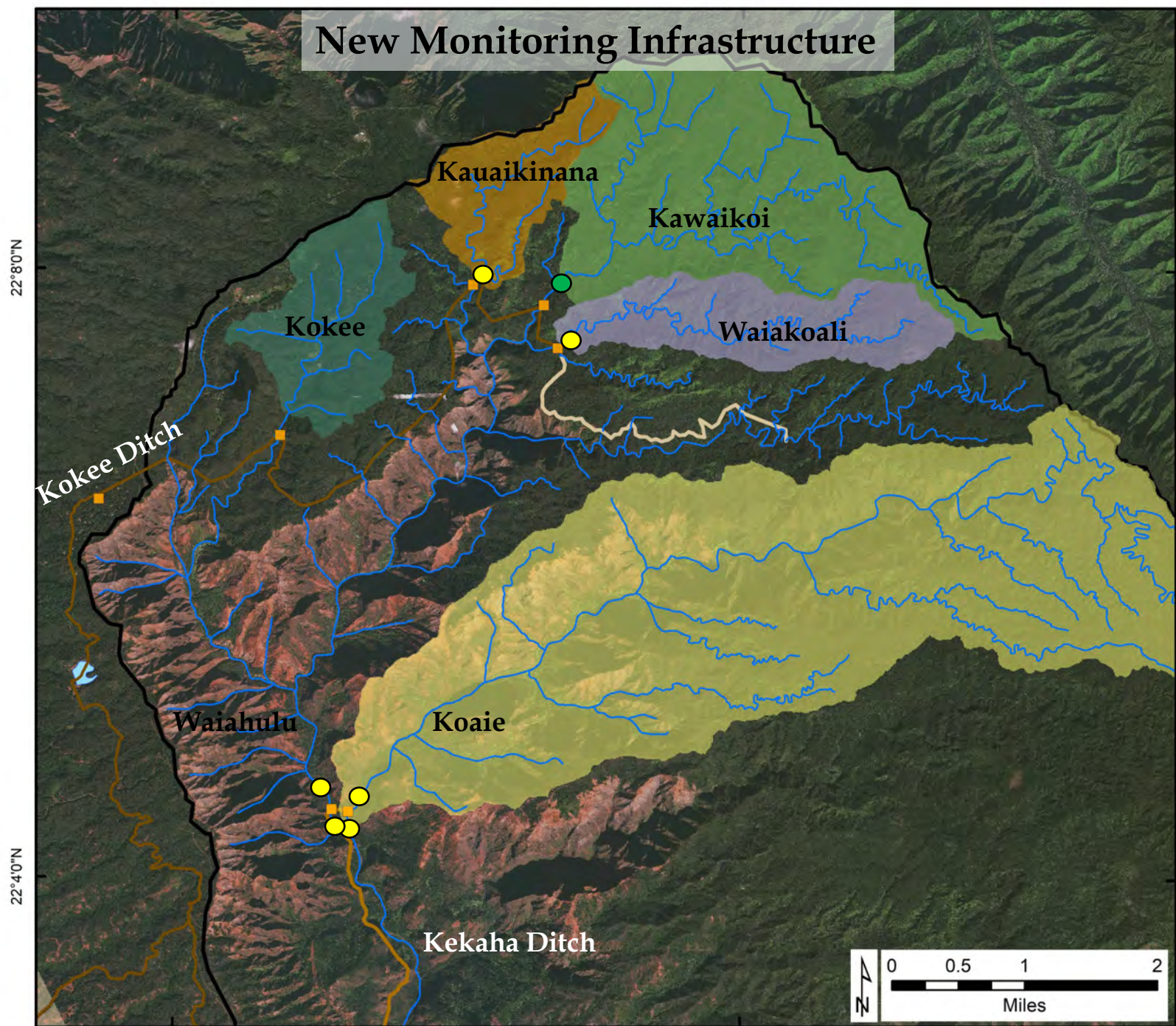
22°4'0"N



159°40'0"W

159°36'0"W

New Monitoring Infrastructure



22°8'0"N

22°4'0"N

Koee Ditch

Kauaikinana

Kawaikoi

Koee

Waiakoali

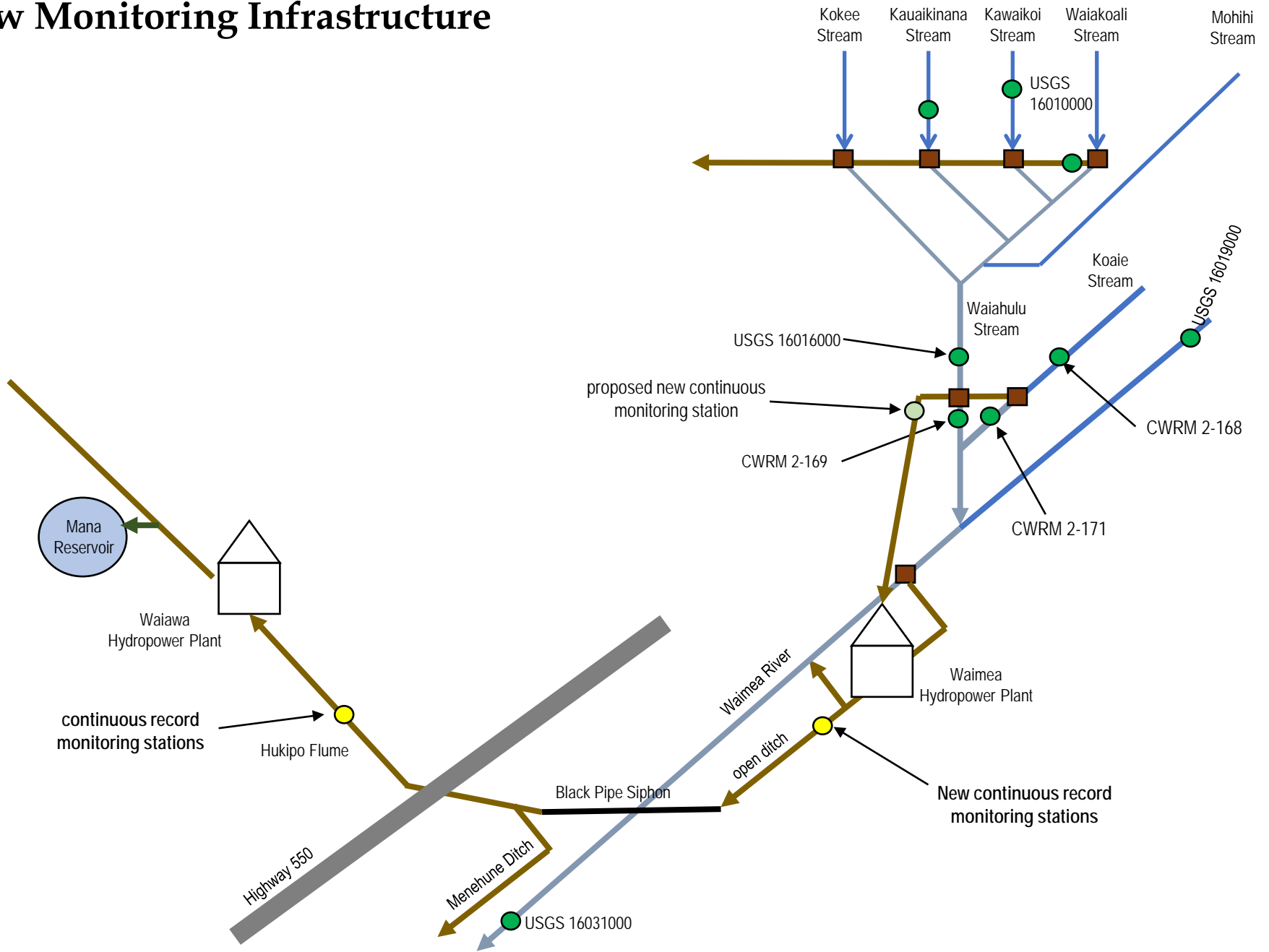
Waiahulu

Koaie

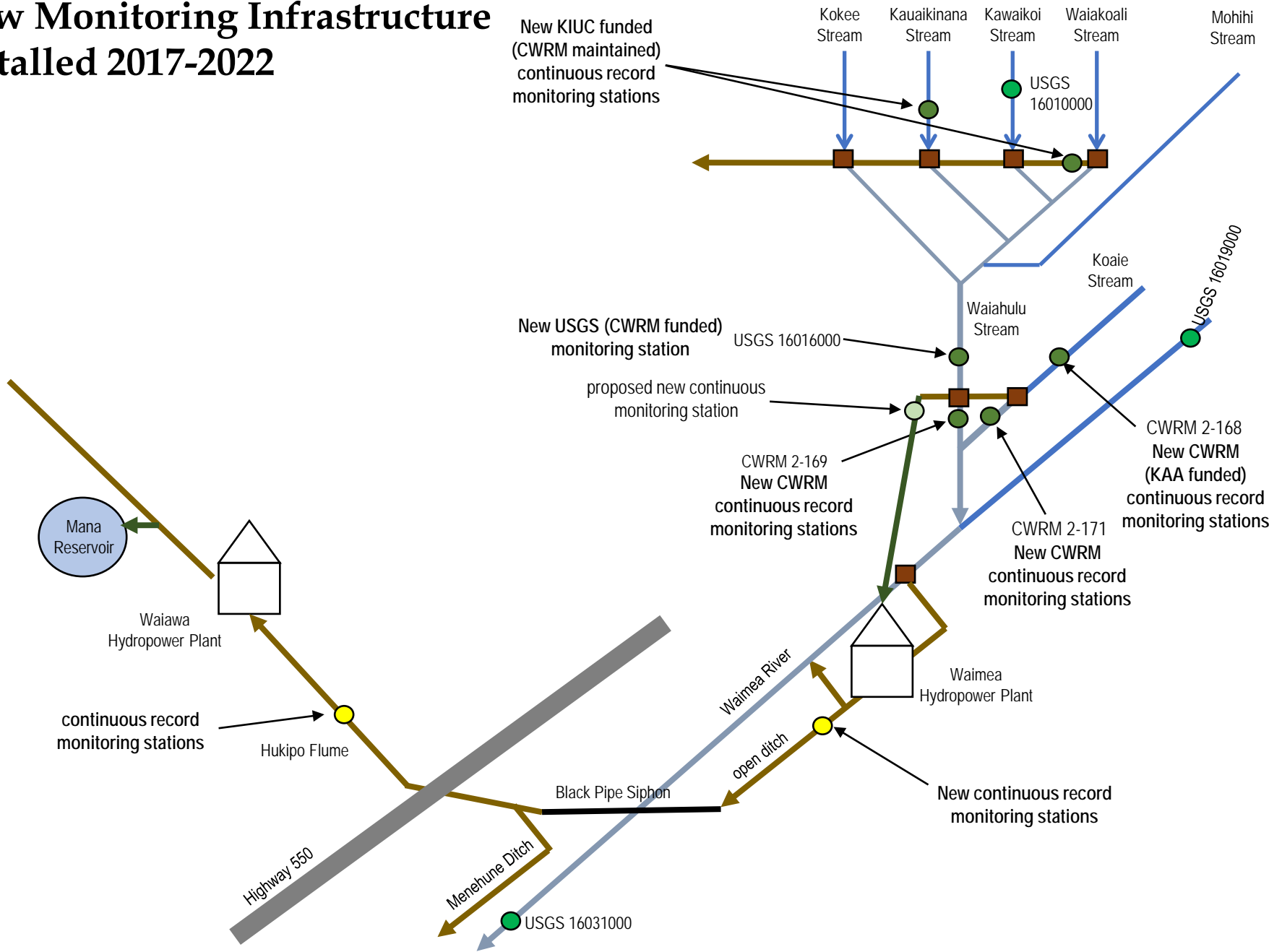
Kekaha Ditch



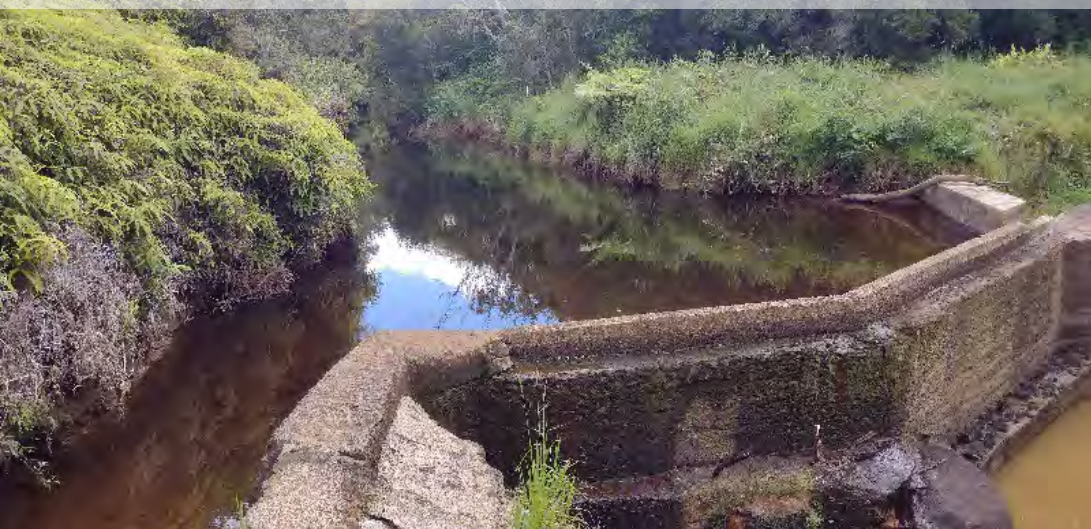
New Monitoring Infrastructure



New Monitoring Infrastructure Installed 2017-2022



Kōke'e Ditch below Waiakoali Intake



KIUC paid \$4000
CWRM annual costs \$6000

Kauaikinana above Kōke'e Ditch



KIUC paid \$4000
CWRM annual costs \$6000

Kauaikinanā above Kōke'e Ditch



Koaie below Kekaha Ditch



CWRM paid \$4000
CWRM annual costs \$6000

Koaie above Kekaha Ditch



KAA paid \$4000
CWRM annual costs \$6000

Koaie below Kekaha Ditch



USGS 16016000 Waimea River above Kekaha Ditch



CWRM paid \$38,000
CWRM annual costs \$26,000

Waimea River below Kekaha Ditch



CWRM paid \$4000
CWRM annual costs \$6000

Waimea River below Kekaha Ditch



Waimea River below Kekaha Ditch



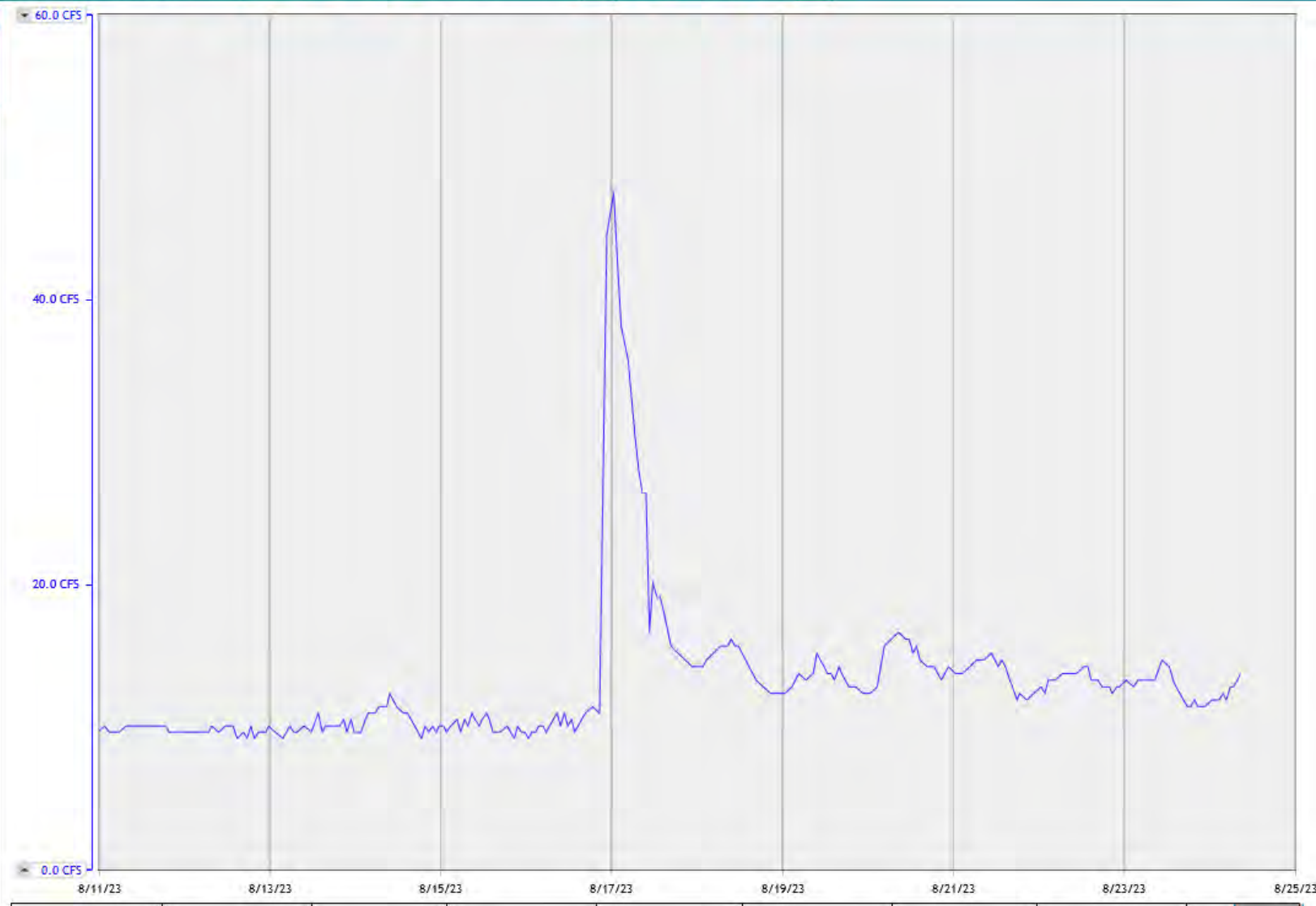
Unforesee Issues



Legend

- Generic Output

13.8 CFS
8/24/23 8:36 AM

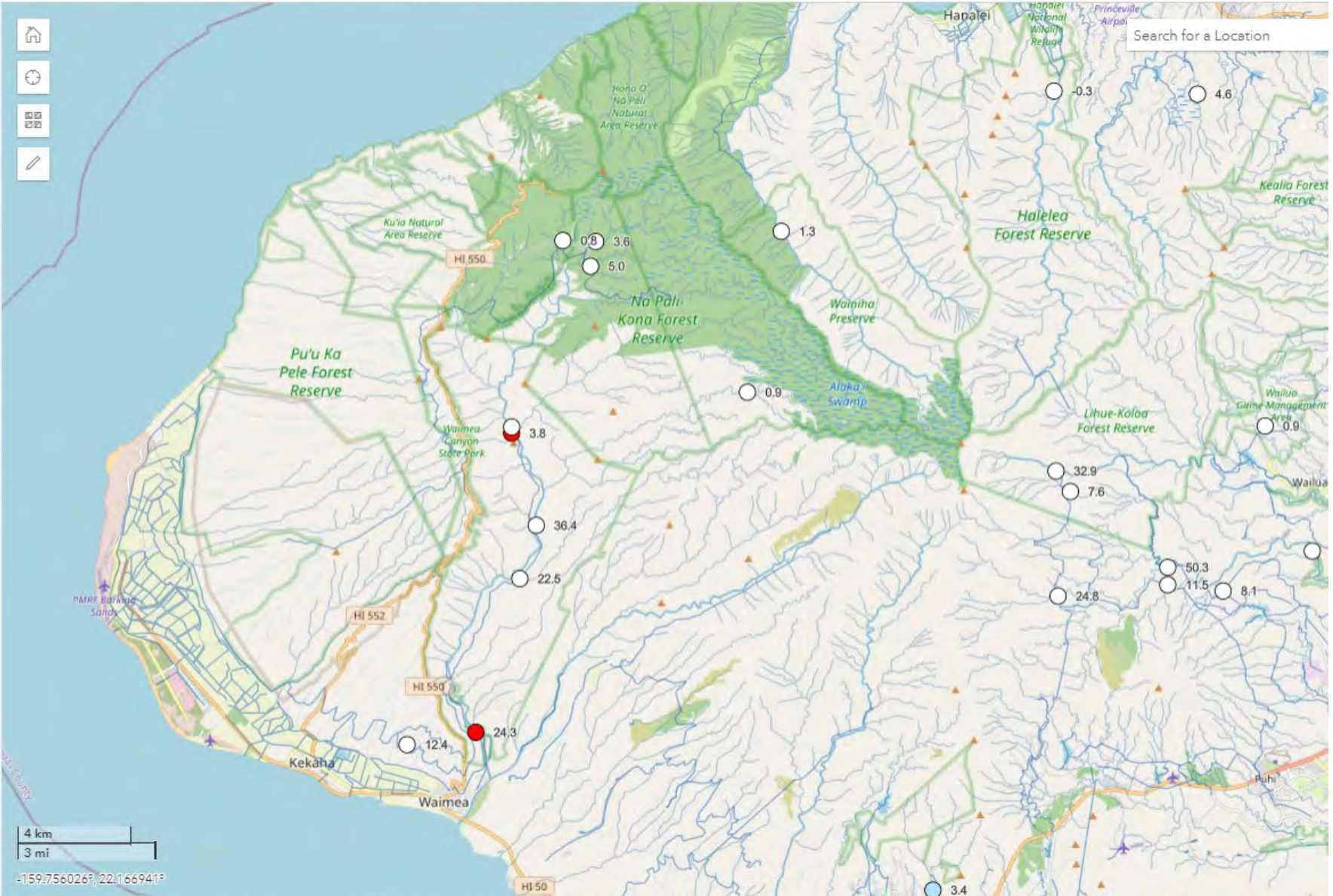


Unforsee Issues



Select Parameter: Discharge Select Value: Latest Discharge Date: Latest Data

Search for a Location



Unforeseen Issues: Limited Access



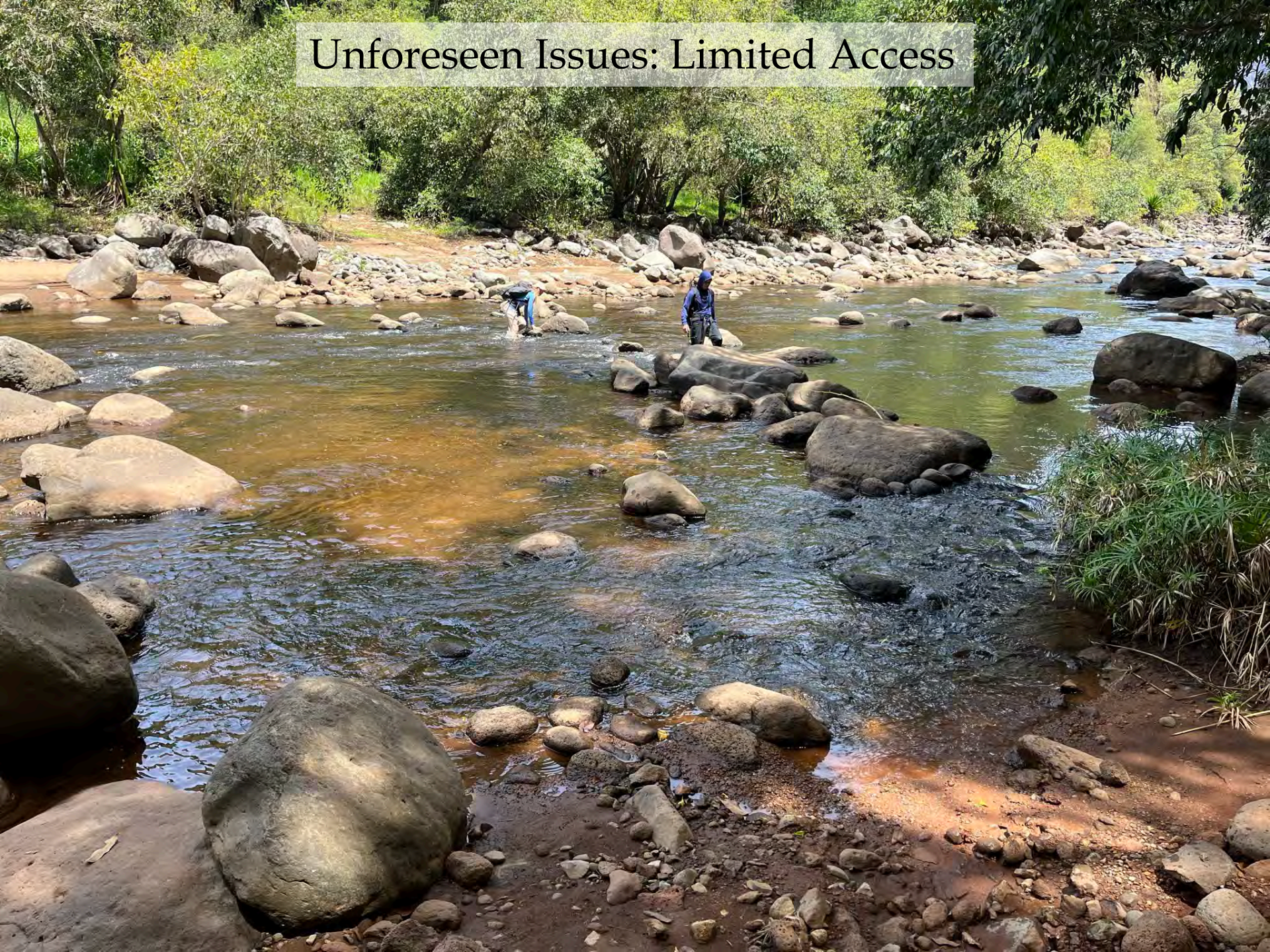
Unforeseen Issues: Limited Access



Unforeseen Issues: Limited Access



Unforeseen Issues: Limited Access



Unforeseen Issues: Siltation of Tunnel



Unforeseen Issues: Siltation of Tunnel



Unforeseen Issues: Length of Permitting



Questions?

