Upcountry Water Source Development

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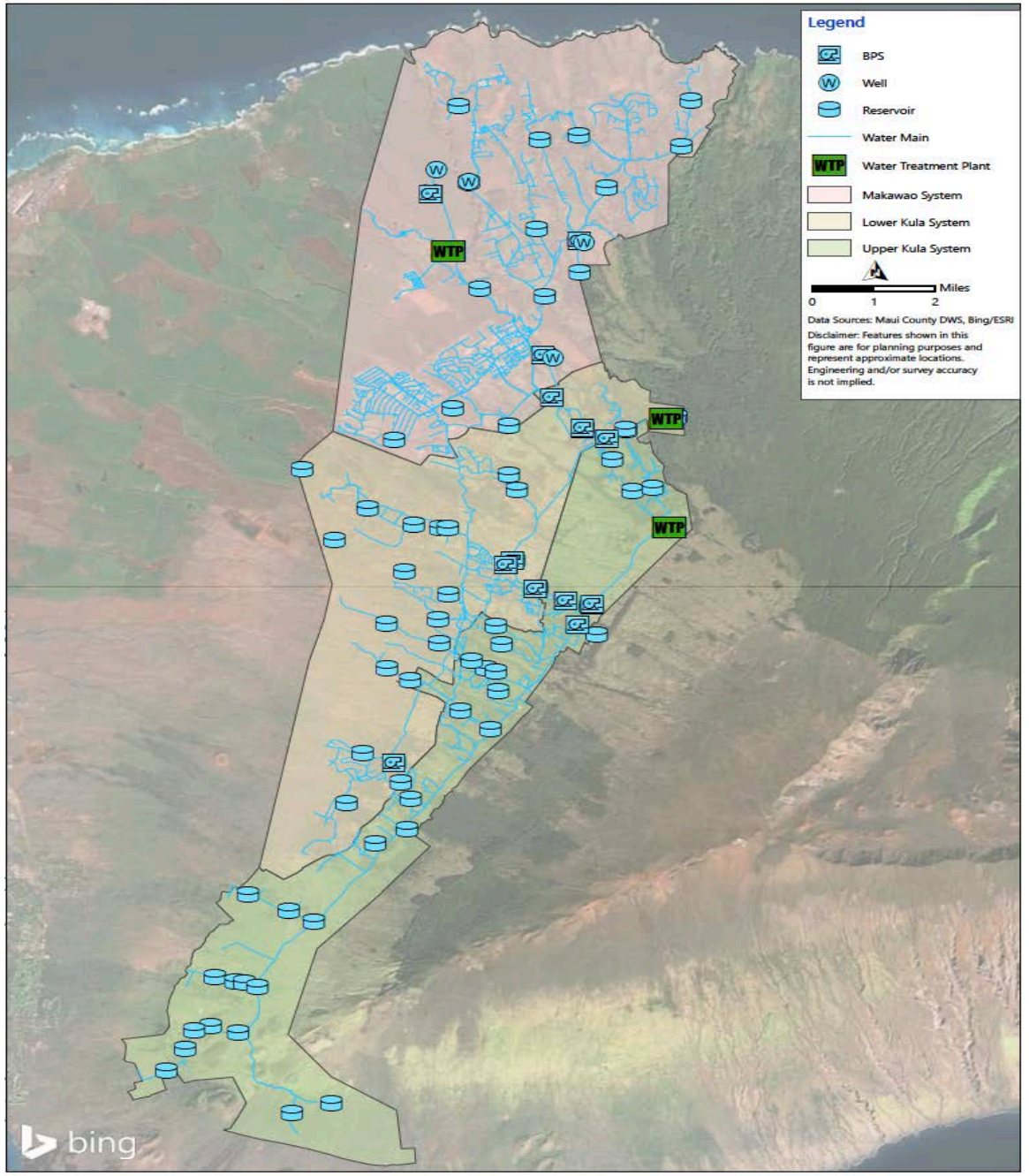
Department of Water Supply

Introduction

Upcountry Water System

Hydraulic Model has allowed detailed analysis of water supply options.



Current Conditions

- Peak Demand (10.1 MGD) exceeds reliable supply (9.7 MGD) by 4%.
- Demand includes inactive meters (0.5 MGD).
- About 68% of reliable supply is surface water.
- Demand from Meter List
  - 1,424 applicants / 3,612 meters / 2.16 MGD
- Initial Goal – Meet current peak demand plus meter list needs.

Water Source Objectives

1. Meet existing demand = +0.4 MGD (million gallons per day)
2. Meet demand on meter list = +2.2 MGD
3. Meet demand for Upcountry System area build out = +4.5 MGD

- Note: DHHL has requested 9 MGD of non-potable for Keokea/Waiohili.
- FY ‘26 budget includes master plan which will consider build-out based on community plan.

Source Augmentation

- Treatment Plant Upgrades
  - Kamole Filter Replacement
  - Kamole Reservoirs
  - Olinda Disinfection
- Additional Wells
  - Buy wells
  - Lease well site with wells
  - Partner with State
  - Drill County wells

Kamole Filter Replacement

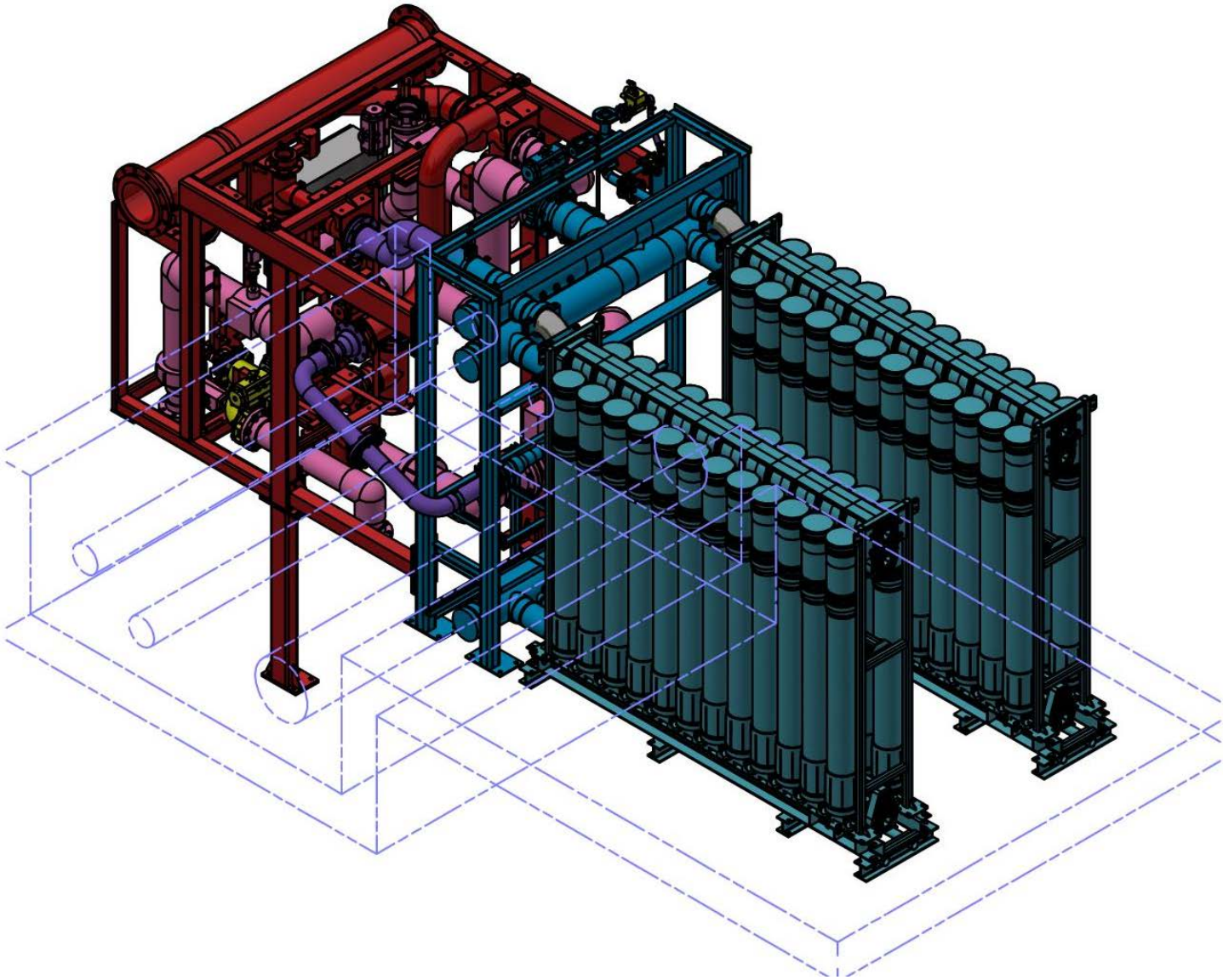
- Increases reliable capacity from 4.0 MGD to 5.5 MGD
- Increases reliable capacity Upcountry from 9.7 MGD to 11.2 MGD
- Will allow resumption of processing of meter list.
- Projected Cost = $5 million

- Requesting additional allocation from Wailoa ditch.
- Timing – underway, expected completion Spring 2026.
- DWS will be requesting an additional allocation from BLNR-CWRM of 12 MGD at the end of 2025.
- With additional allocation, reliable capacity can be 13.7 MGD.

Kamole Filter Replacement

KEY:

- RED: Existing
- PINK: Build and Installed in the Field. PVC
- VIOLET: Built Outside, Finished in the Field, Stainless Steel
- BLUE: Shipped as Skids and Installed in the Field
- YELLOW: Spool Reused from Other End of the Original Skid

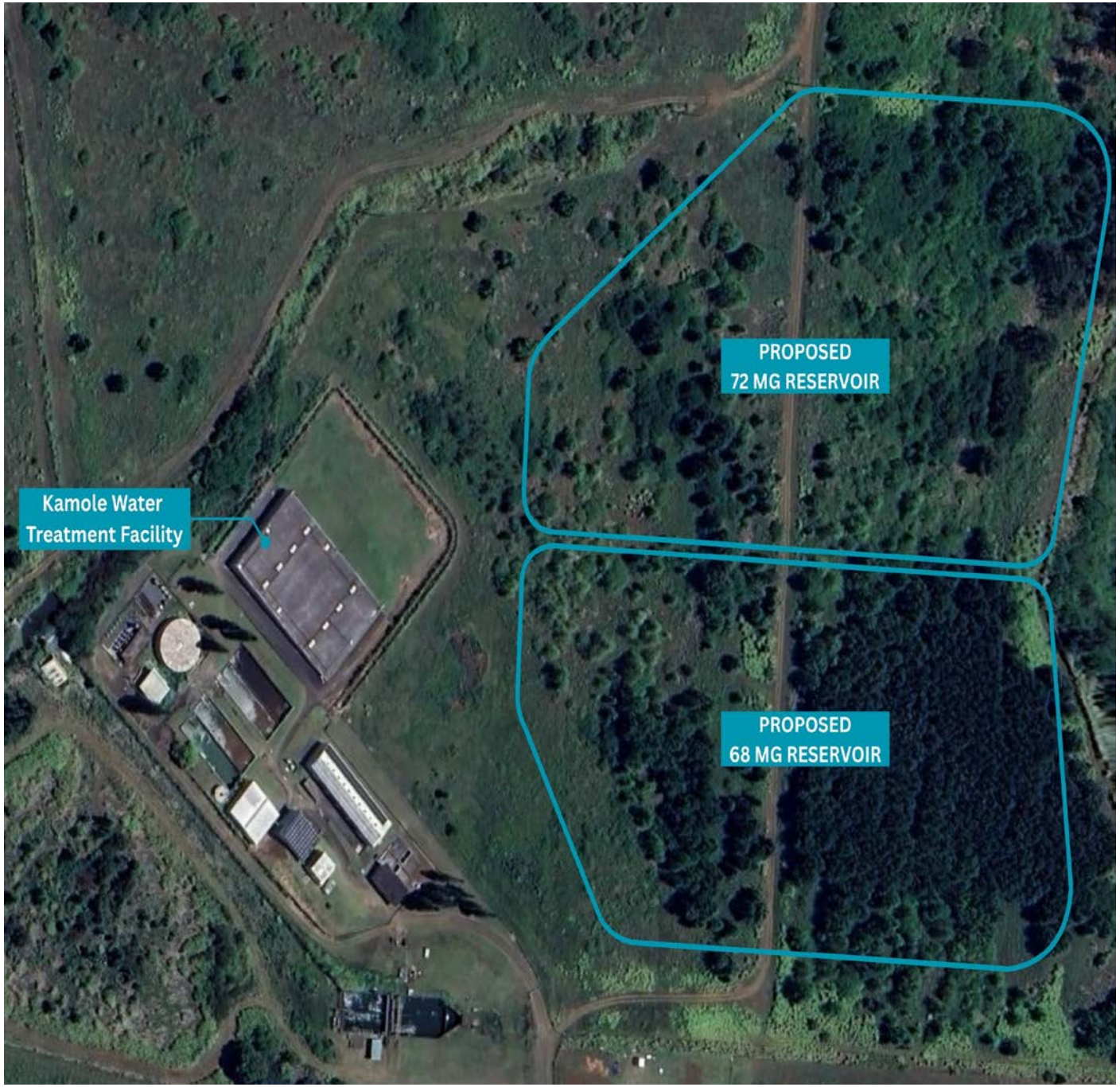


Kamole Reservoirs

- Design in FY ‘26 budget
- $1.4M design FY ‘26 / $25M construction FY ‘28
- Seeking federal funding.
- 140 million-gallon capacity
- Will allow capture of high flows.
- Will address losses due to turbidity.
- Will enhance reliability.

Kamole Reservoirs

Proposed locations.



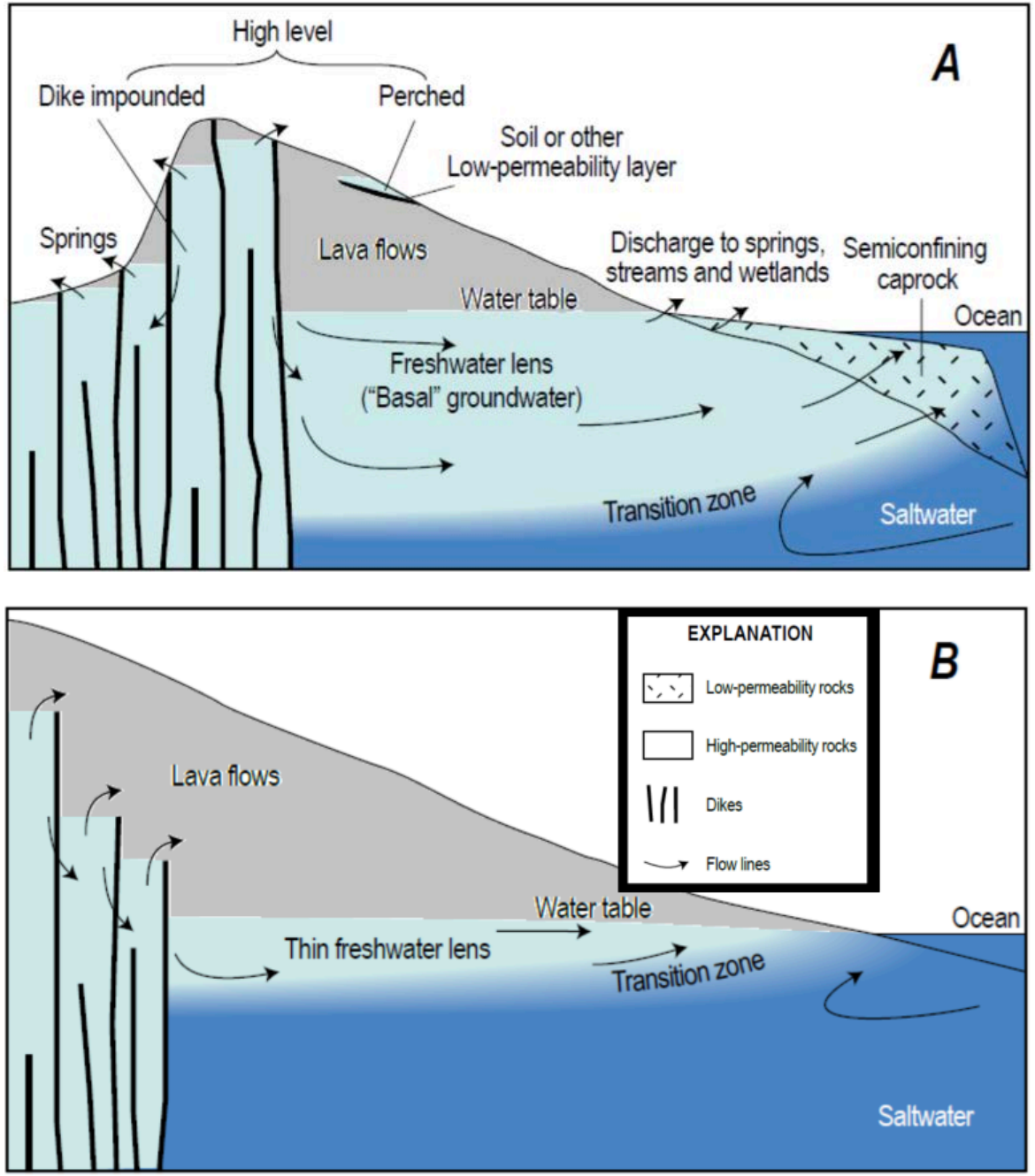
Olinda Disinfection

- Change from chloramines to free chlorine.
- Result – all treatment plants will be using same disinfection method.
- Allows complete flexibility in Upcountry operations.
- Analysis of evaluation is complete.
- Bench scale plant under design.
- Cost = TBD

Olinda Treatment Plant

Additional Wells

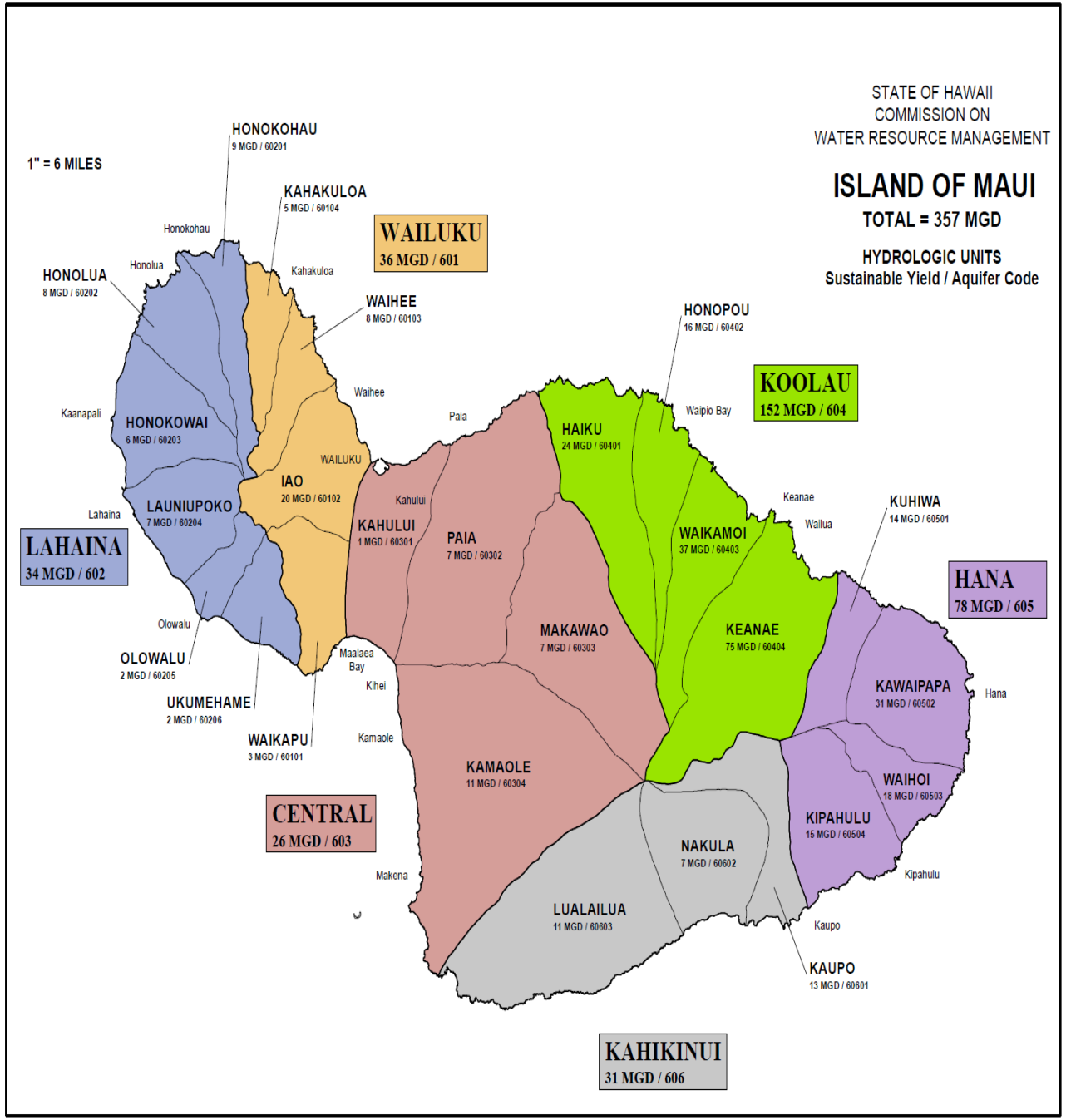
Model Showing Caprock, Dike-Impounded Water, and Basal Water



Aquifer Sectors and Systems of Maui

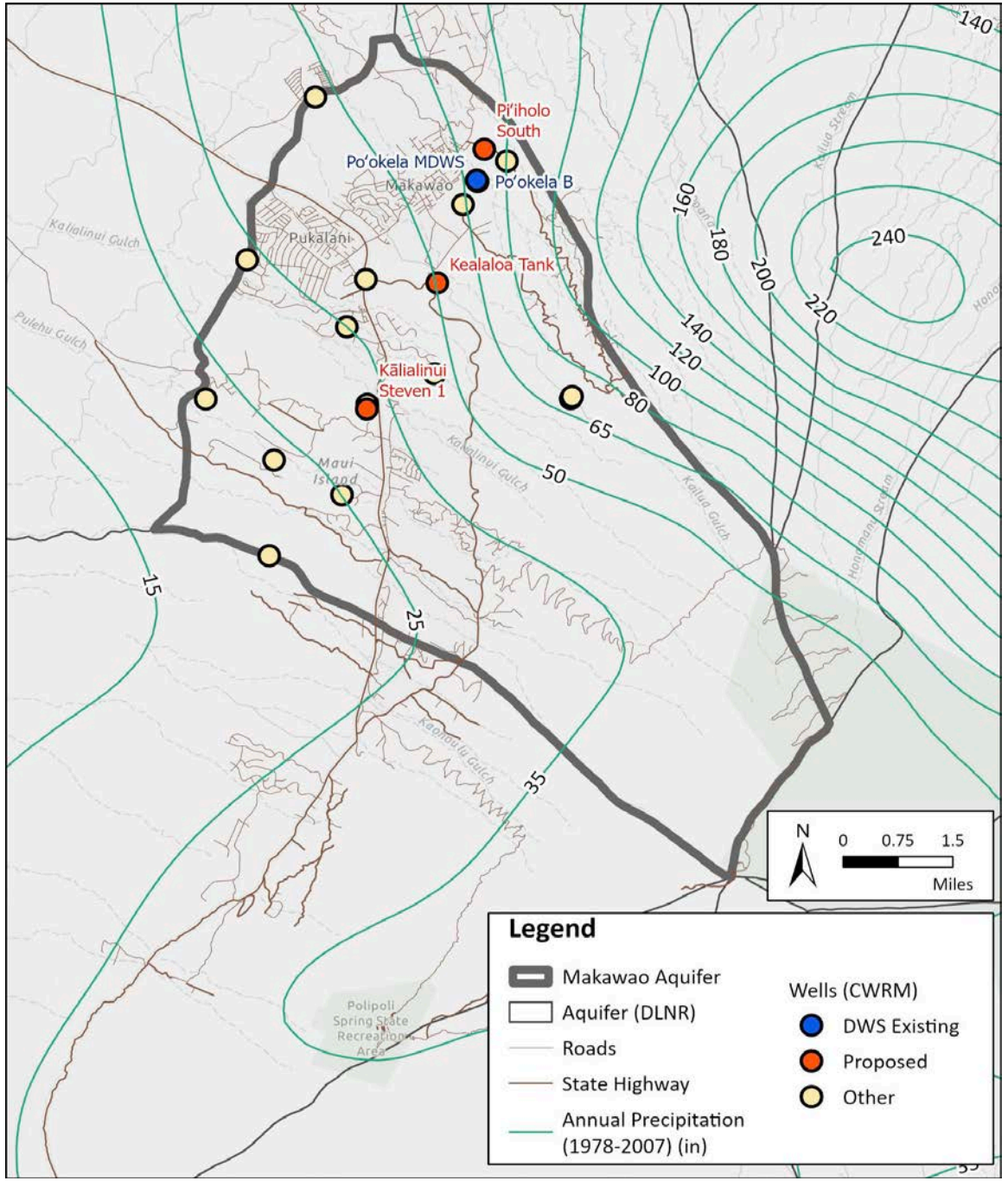
The Makawao Aquifer System lies within the Central Aquifer Sector of Maui.

The Makawao Aquifer System spans approximately 229 square miles, with elevations ranging from approximately 9,600 ft near the peak of Haleakalā to the 1,100 ft elevation where it transitions into the Pāʻia Aquifer System.



Precipitation in the Makawao Region

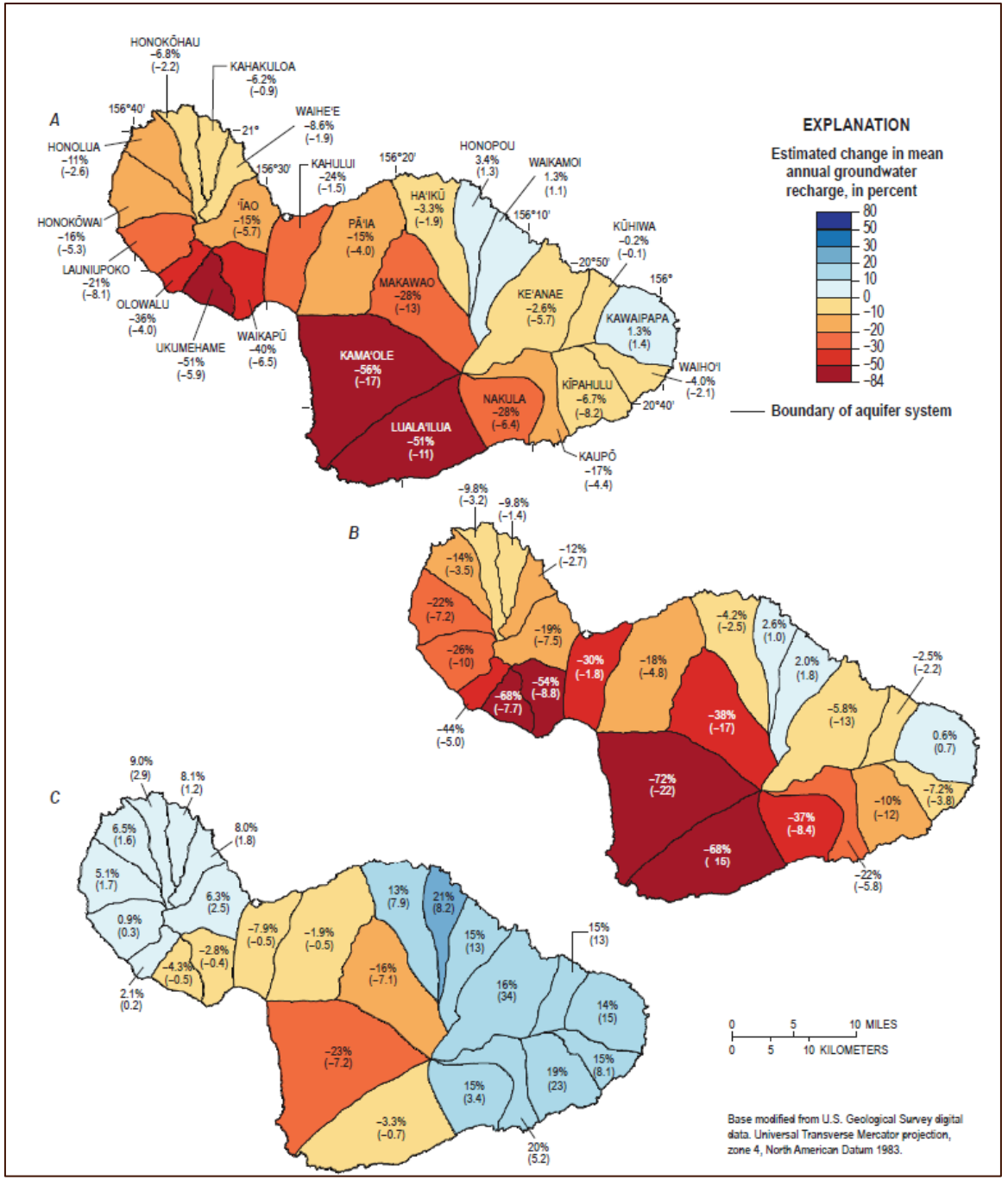
Precipitation decreases from northeast to southwest.



Groundwater Recharge Scenarios

The U.S. Geological Survey recently calculated predicted changes to groundwater recharge on Maui.

Mean annual precipitation projections for both wet and dry scenarios project a rainfall decrease over the next 75 years and mean annual groundwater recharge is also predicted to decrease by 16 to 38% depending on the climate change scenario.



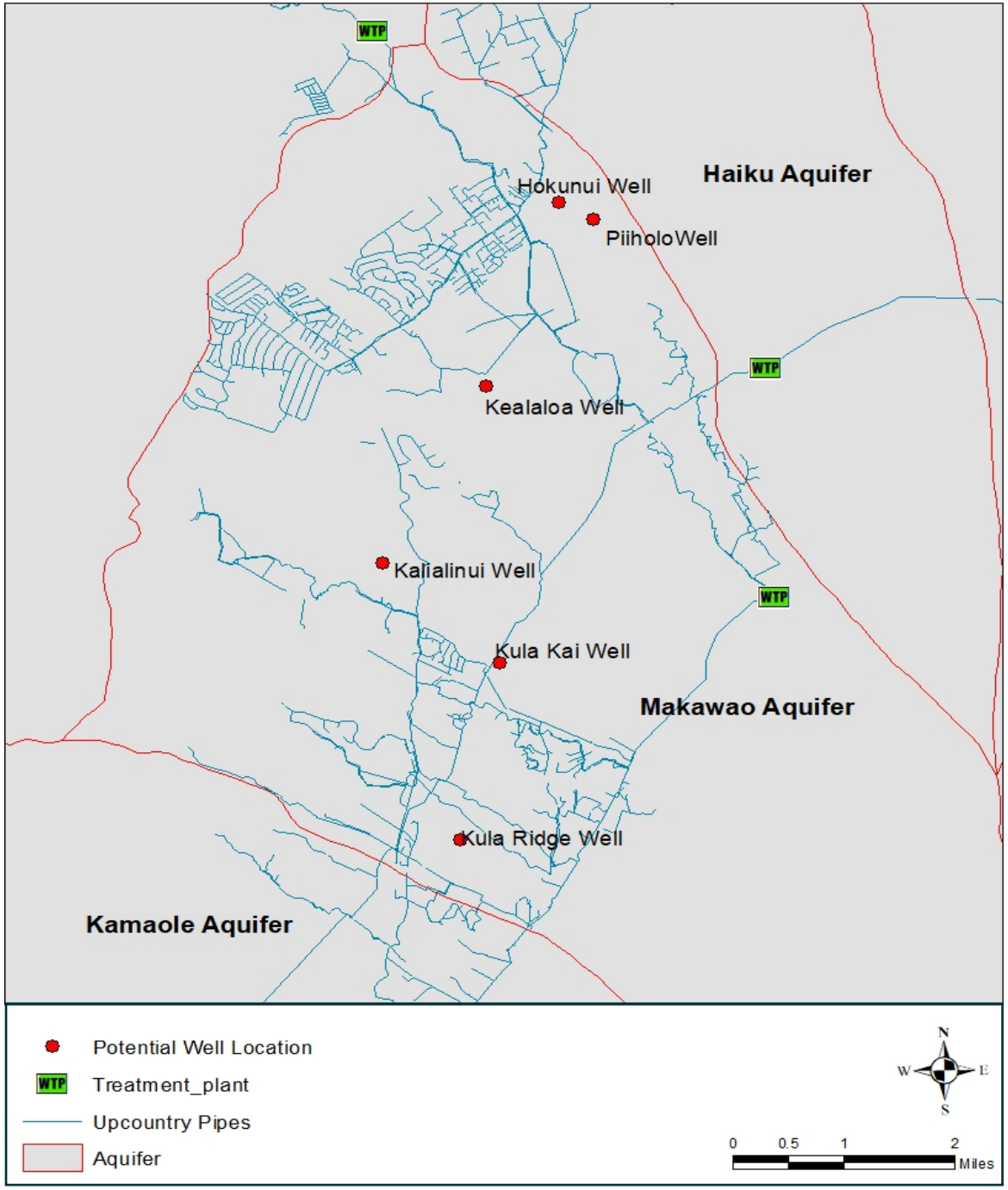
Criteria for Wells

- Acquisition process (lease, purchase, partner, drill)
- Hydrogeology – aquifer capacity, expected production, impact on surrounding wells
- Connection issues – ease of connection and benefit provided to County system
- Availability of power – HECO and on-site solar
- Cost and timing – sources of funding, timing of availability, and timing for expenditures
- Water quality – preference given to sites with low risk of contamination

Sources Map

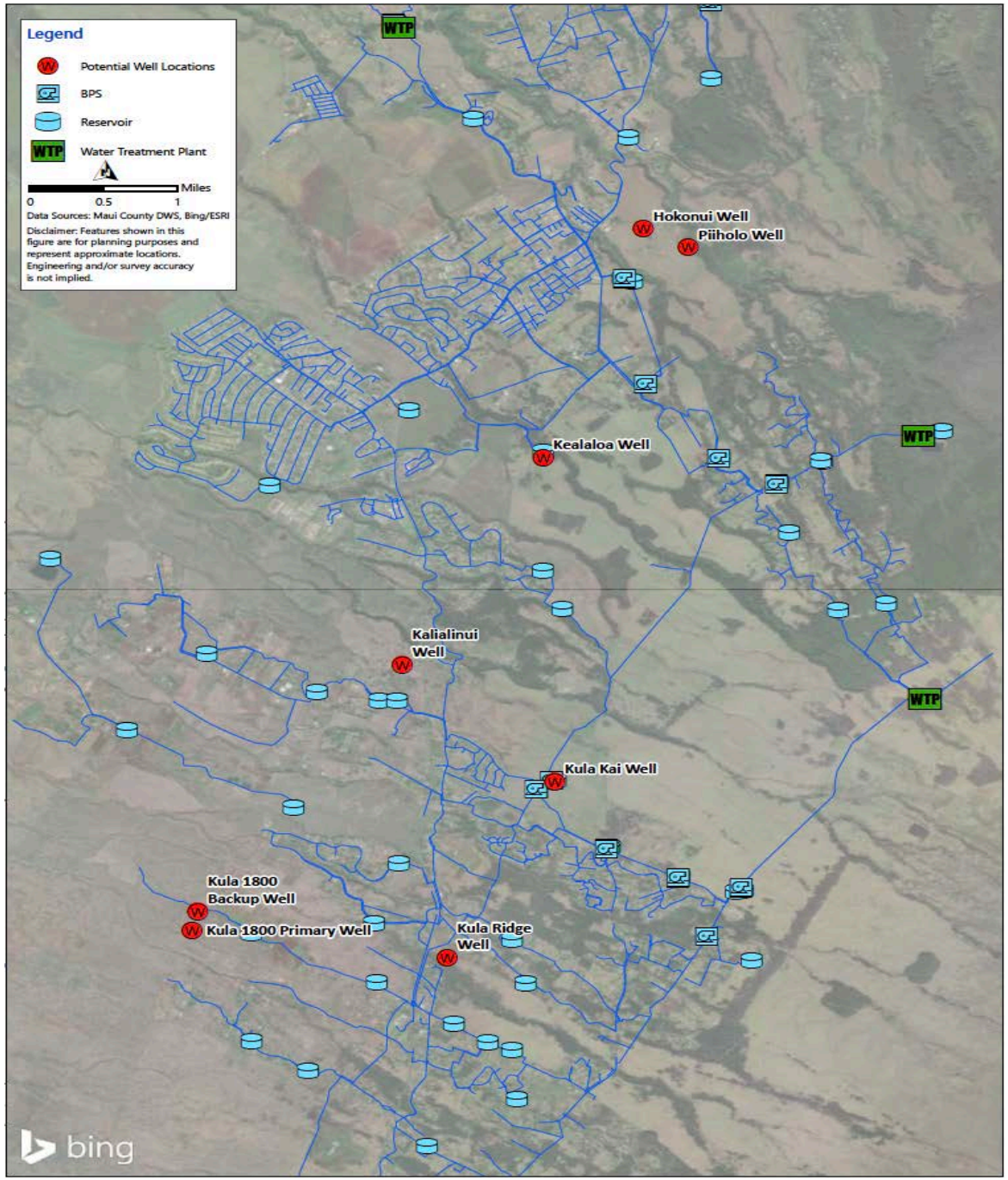
MDWS is considering acquiring or drilling six additional wells in the Makawao Aquifer.

Well development in the Makawao Aquifer is a key strategy in the Water Use and Development Plan to meet demand in the DWS Upcountry System.

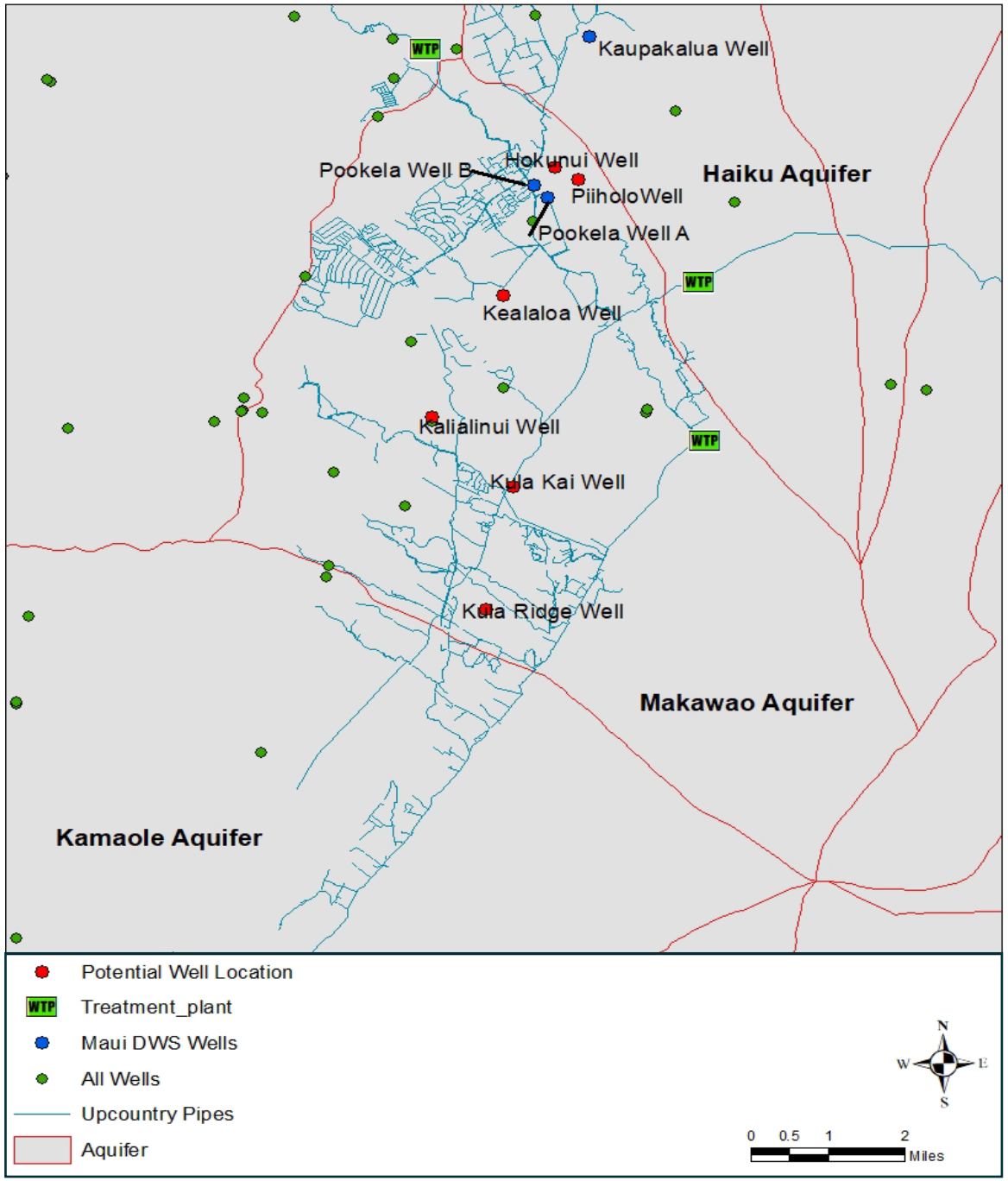


Map of Possible Wells

The proposed wells are ideally distributed to serve the County system.



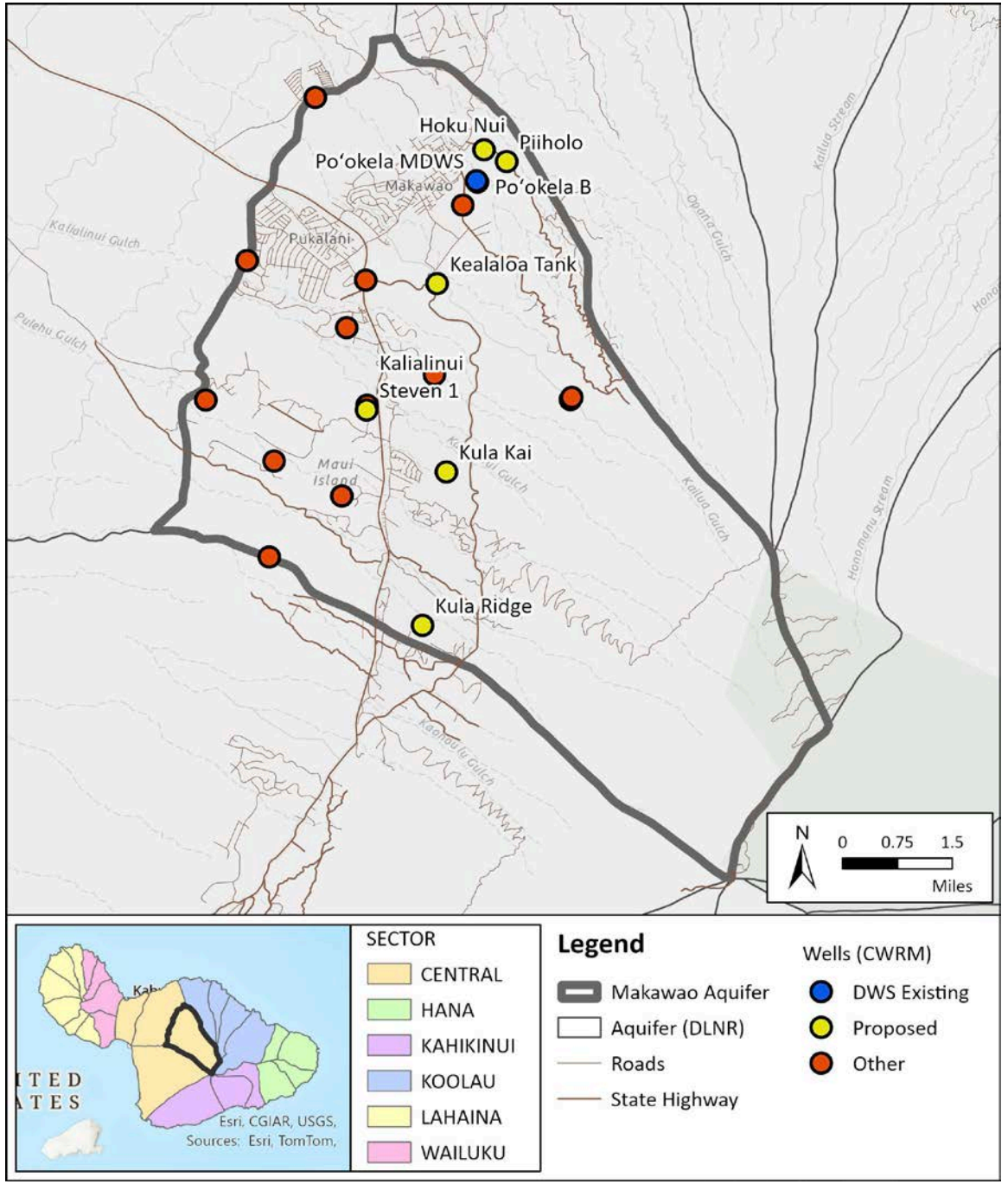
Map of All Nearby Wells



New Existing and Proposed Wells

The wells are ideally distributed from the perspective of aquifer management.

The proposed wells are not expected to have an impact on existing wells.



Non-MDWS Groundwater Uses

It is important to minimize impacts on other groundwater users. As stated earlier, the public trust uses of Groundwater Dependent Ecosystems (GDE), Traditional and Customary (T&C) uses, DHHL Reservations, and domestic drinking water are the highest priority, but other users also should be considered.

There are no known DHHL Reservations in the Makawao Aquifer System but there are drinking water sources and possibly GDE and T&C uses.

Makawao Wells

There were 19 wells and tunnels registered with CWRM in the Makawao Aquifer System as of June 2025.

17 are reporting pumpage to CWRM.

Well ID	Well Name	Use	Owner/User	Pump Capacity (gpm)	Avg Withdrawal (MGD) (2024)
6-4920-001	Anuhea Place	DOM	Hale O Kaula Inc.	109	0.009
6-4619-001	Boschetti 1	MUNPR	Allen T. Yap		0
6-5220-001	Hāliʻimaile	AGRCP	Maui Land & Pineapple Company, Inc, MLPC	700	0
6-4819-001	**Kalialinui Steven 1**	AGRCP	Marc & Tara Steven		0
6-4819-002	Kalialinui Steven 2	AGRCP	Marc & Tara Steven		0
6-4918-001	**Kealaloa Tank**	MUNCO	State of Hawaiʻi, DLNR, Engineering Division		Not reporting
6-4621-002	Kula 1800 No. 2	UNU	AX 1800 LCC	0	0
6-4818-001	KulaKoa	AGRLI	Art Ranch, LLC	220	0.005
6-5018-001	Maluhia	AGRCP	Thomas Baldwin Nonexempt Trust	48	0.002
6-4821-001	Ōmaʻopio-Esty	MUNPR	Edward Esty	65	0.028
6-5118-003	**Piʻiholo**	UNU	Maui Land & Pineapple Company, Inc, MLPC		0
6-5118-004	**Piʻiholo South (Hoku Nui)**	AGRLI	Hoku Nui Maui LLC	205	0.007
6-5018-002	Poʻokela B	MUNCO	MDWS		0.685
6-5118-002	Poʻokela MDWS	MUNCO	MDWS	900	0.738
6-5021-001	Pukalani Golf	IRRGC	Pukalani Country Club LLC	1000	0.285
6-4719-001	Pūlehu Farms	MUNPR	Kula IO Green LLC	320	0.034
6-4720-001	Siele	DOM	Jason L Eckhoff 2012 Trust	85	Not reporting
6-4817-001	Waihoʻi Tunnel	UNU	State of Hawaiʻi	n/a	0.00
6-4817-002	Waihoʻi Tunnel	UNU	State of Hawaiʻi	n/a	0.00

Makawao Wells

Note that 8 out of the 19 wells in the Makawao Aquifer System are public trust protected drinking water wells.

Use	Number of Wells
Municipal Private (MUNPR)	3
Municipal County (MUNCO)	3
Irrigation Golf Course (IRRGC)	1
Agriculture (GPRCP, AGRLI)	6
Domestic (DOM)	2
Unused (UNU)	4
SUM	19
Active (2023)	11

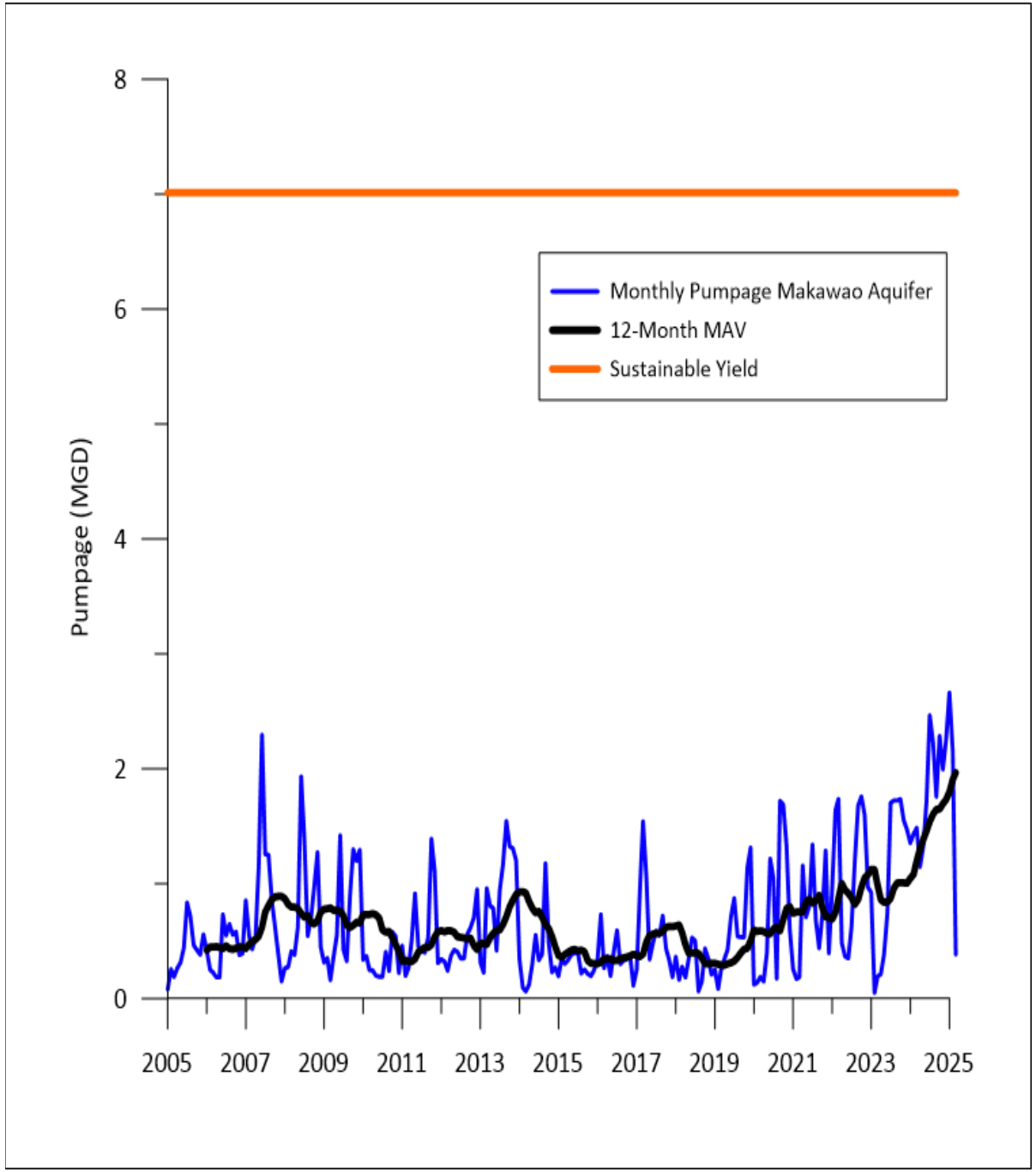
Wells with Domestic or Municipal Use

There are eight wells in the aquifer system which are listed as municipal or domestic use.

Well ID	Well Name	Use	Owner/ User	Pump Capacity (gpm)	Avg Withdrawal (MGD) (2024)
6-4920-001	Anuhea Place	DOM	Hale O Kaula Inc.	109	0.009
6-4619-001	Boschetti 1	MUNPR	Allen T. Yap		0
6-4918-001	Kealaloa Tank	MUNCO	State of Hawaii, DLNR, Engineering Division		Not reporting
6-4821-001	Ōmaʻopio-Esty	MUNPR	Edward Esty	65	0.028
6-5018-002	Poʻokela B	MUNCO	MDWS		0.685
6-5118-002	Poʻokela MDWS	MUNCO	MDWS	900	0.738
6-4719-001	Pūlehu Farms	MUNPR	Kula IO Green LLC	320	0.034
6-4720-001	Siele	DOM	Jason L Eckhoff 2012 Family Trust	85	Not reporting

Makawao Pumpage

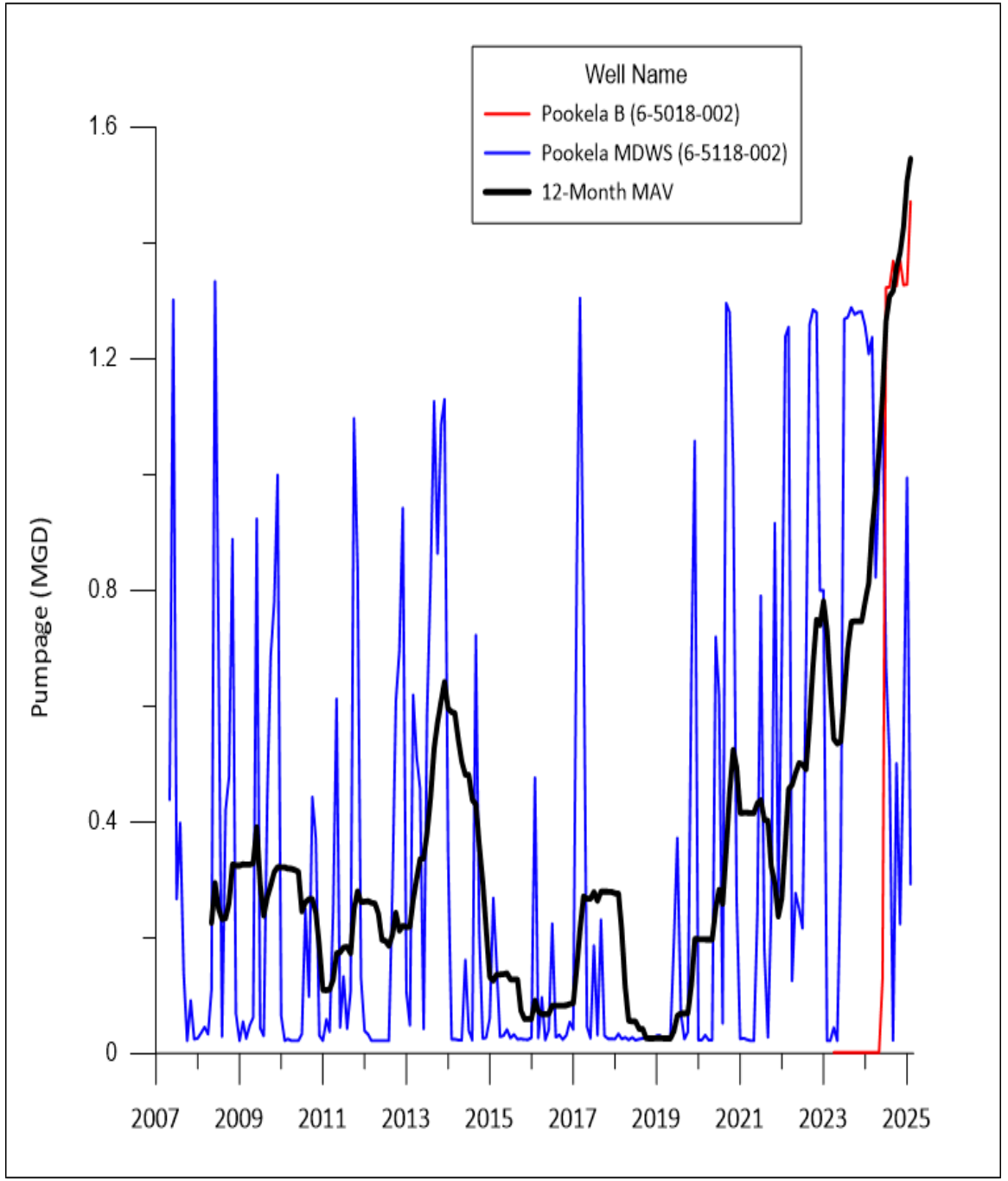
The 12-month moving average (12-MAV) (Feb. 2024 - Feb. 2025) of the Makawao Aquifer System was 1.9 MGD.



DWS Well Pumpage

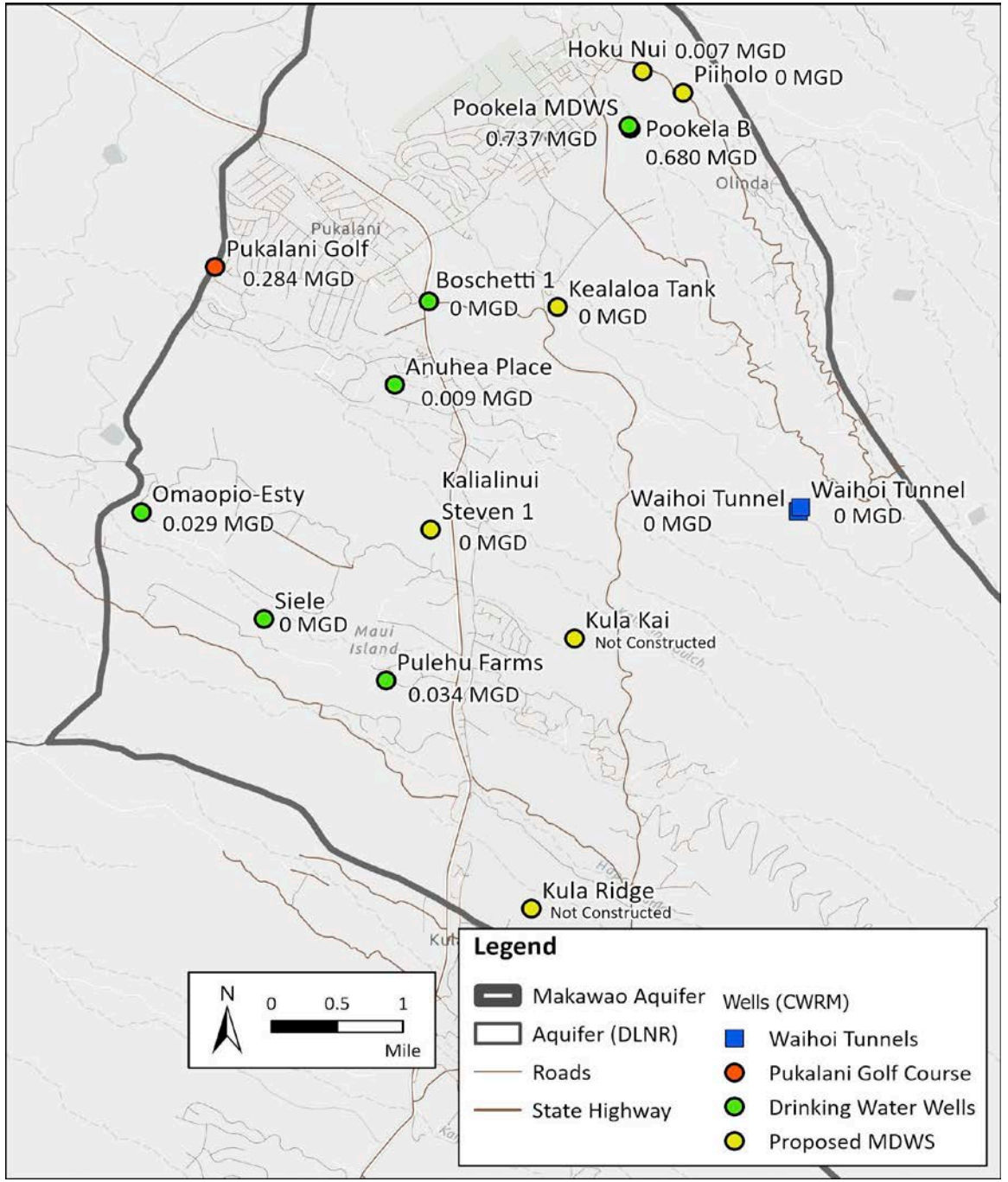
Most groundwater users draw relatively small amounts of water - less than 0.1 MGD.

The three large users include the two MDWS Po‘okela Wells at 1.423 MGD.



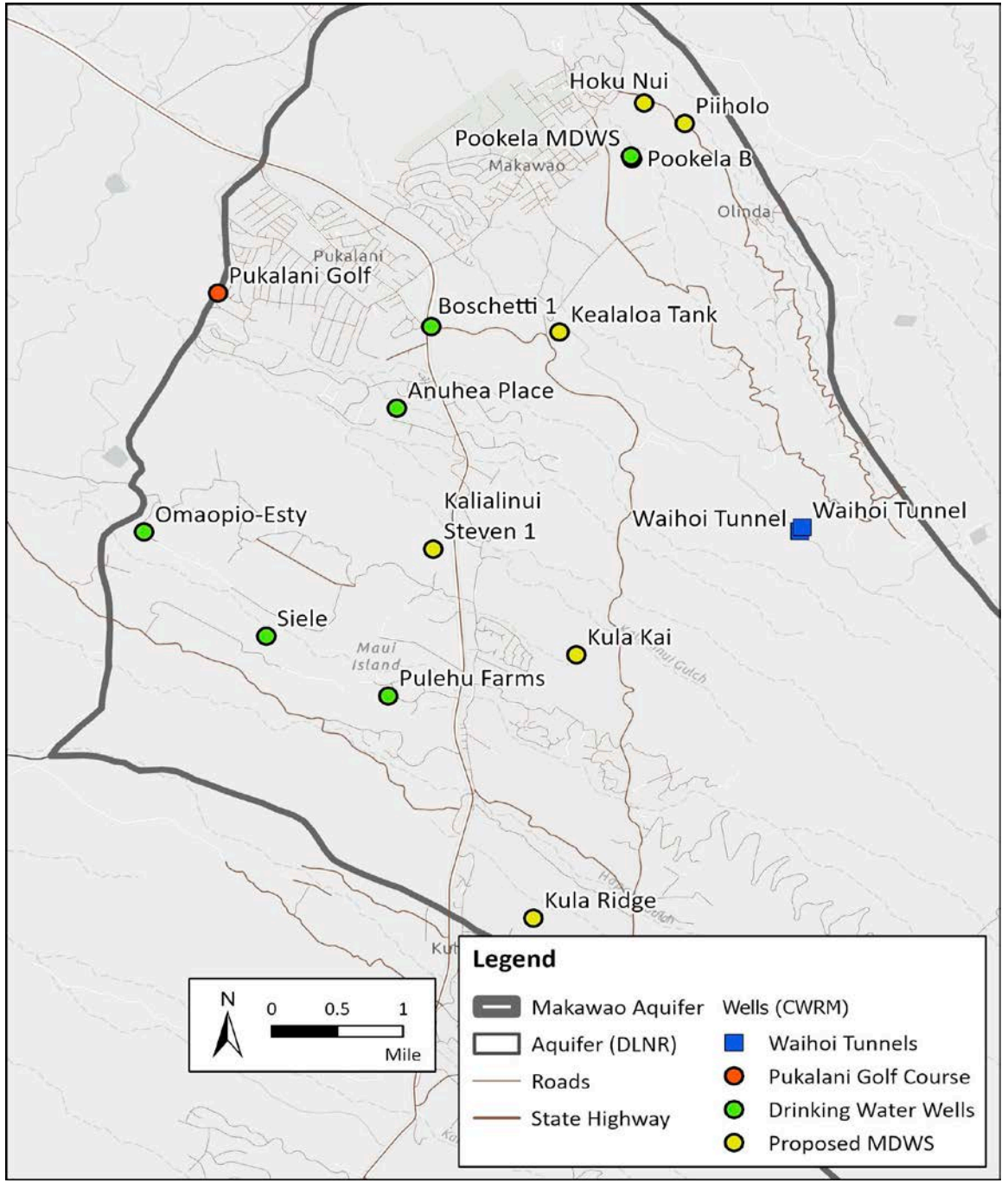
Makawao Pumpage

This map shows the wells on a map with the 2024 average pumpage (MGD).



Non-MDWS Groundwater Uses

The proposed MDWS wells are each over a mile from the nearest other public trust protected well and are not expected to impact neighboring uses.

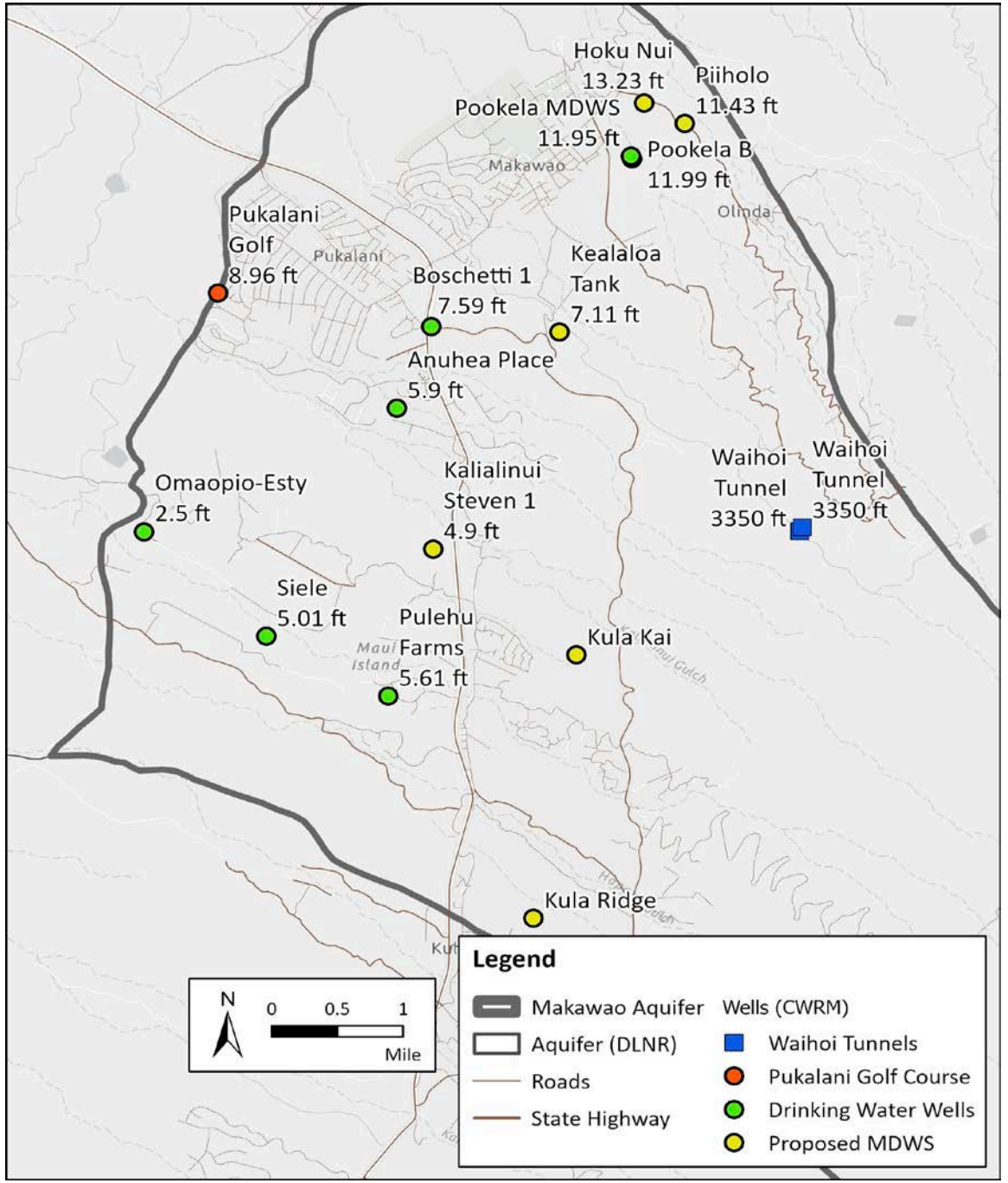


Water Levels

Reported water levels in Makawao are highest (~12 feet MSL) in the north near the relatively high rainfall rift zone and lowest in the makai areas near the boundary with the Pāʻia Aquifer System (2.5 feet MSL).

The high-water levels in the north are positive evidence supporting the development of higher capacity wells at Hoku Nui and possibly Piʻiholo.

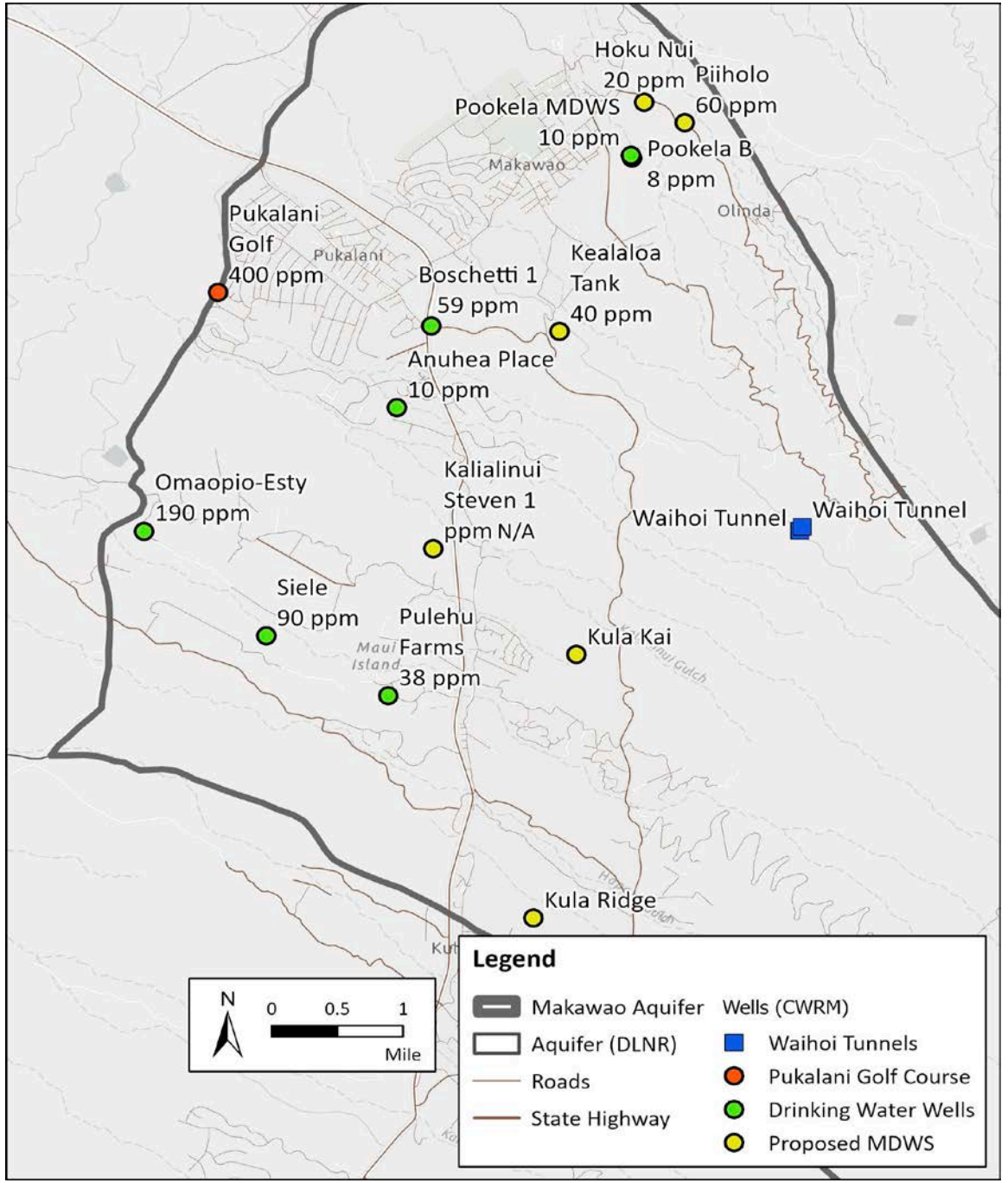
The low-density well distribution in the southern areas with lower groundwater levels is appropriate for this area.



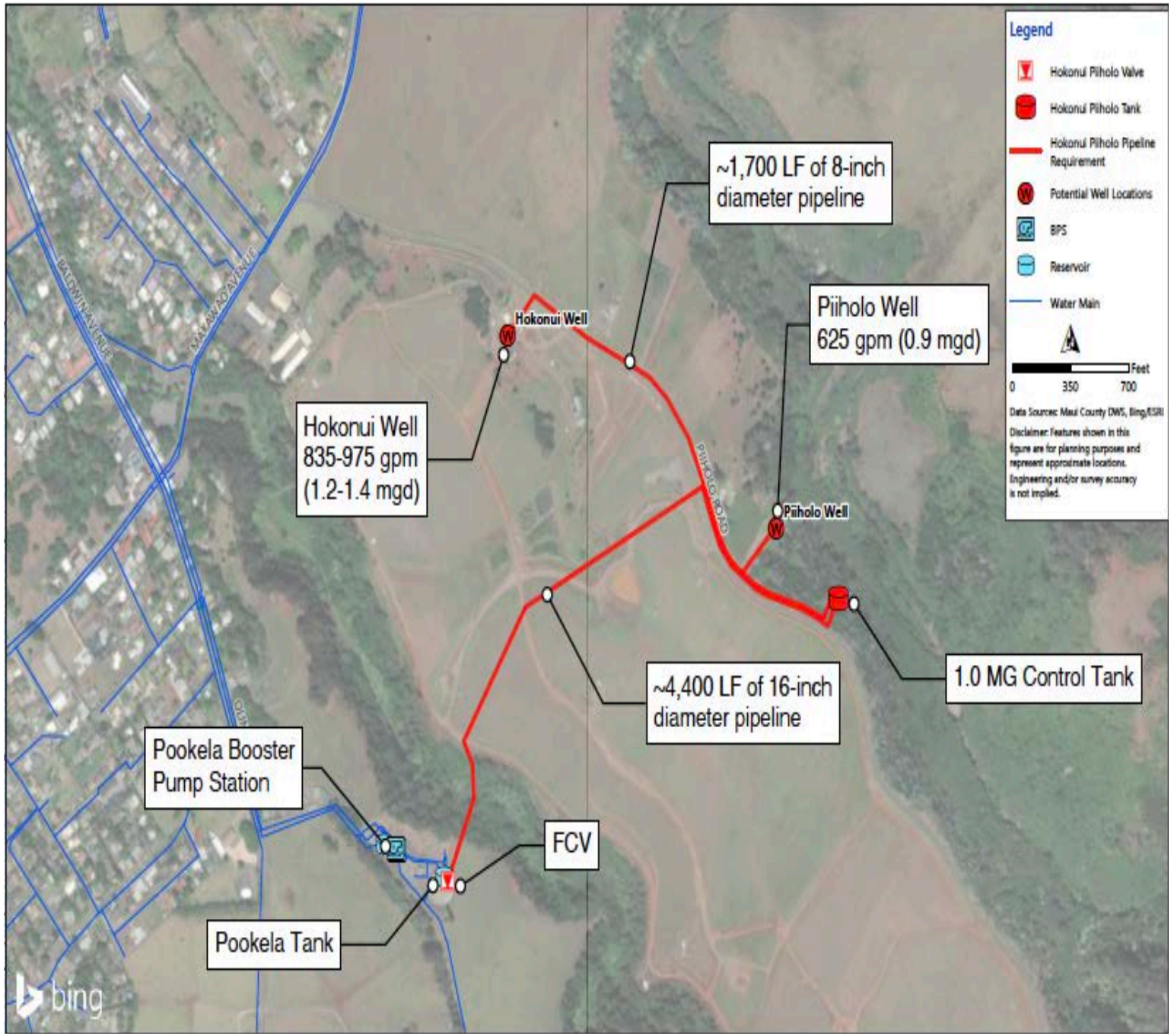
Salinity

Salinity levels expressed as chlorides are generally low in Makawao. The lowest elevation wells along the western boundary of the aquifer have the highest chloride levels.

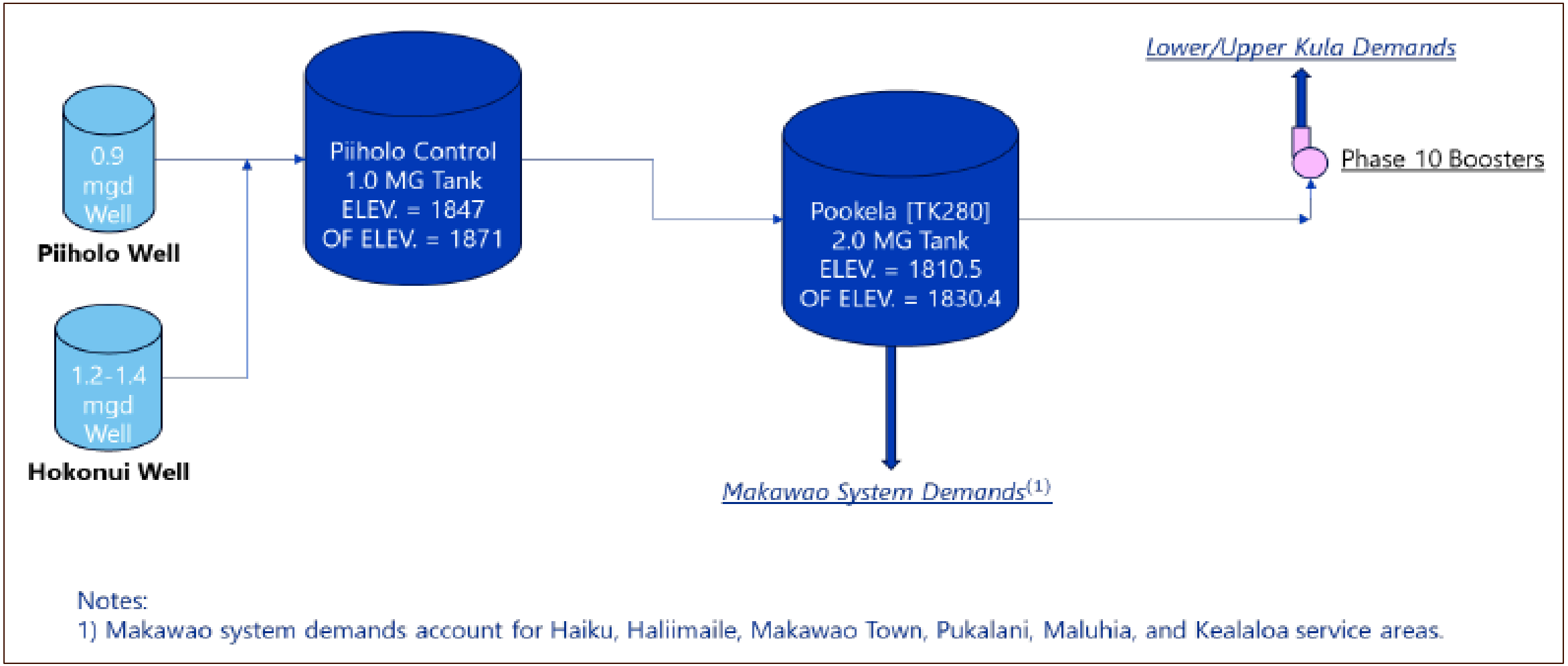
The chlorides at the southern wells, Ōma‘opio-Esty were 190 ppm and at Pukalani were 400 ppm, and these both exceed or approach the 250ppm level. This indicates that the opportunities for municipal water well development are better further mauka.



Hoku Nui and Pi'iholo Wells



Schematic of Hoku nui and Pi'iholo Wells



Notes:
1) Makawao system demands account for Haiku, Haliimaile, Makawao Town, Pukalani, Maluhia, and Kealaloa service areas.

Hoku Nui and Pi’iholo Wells

Hoku Nui Well

Pi’iholo Well

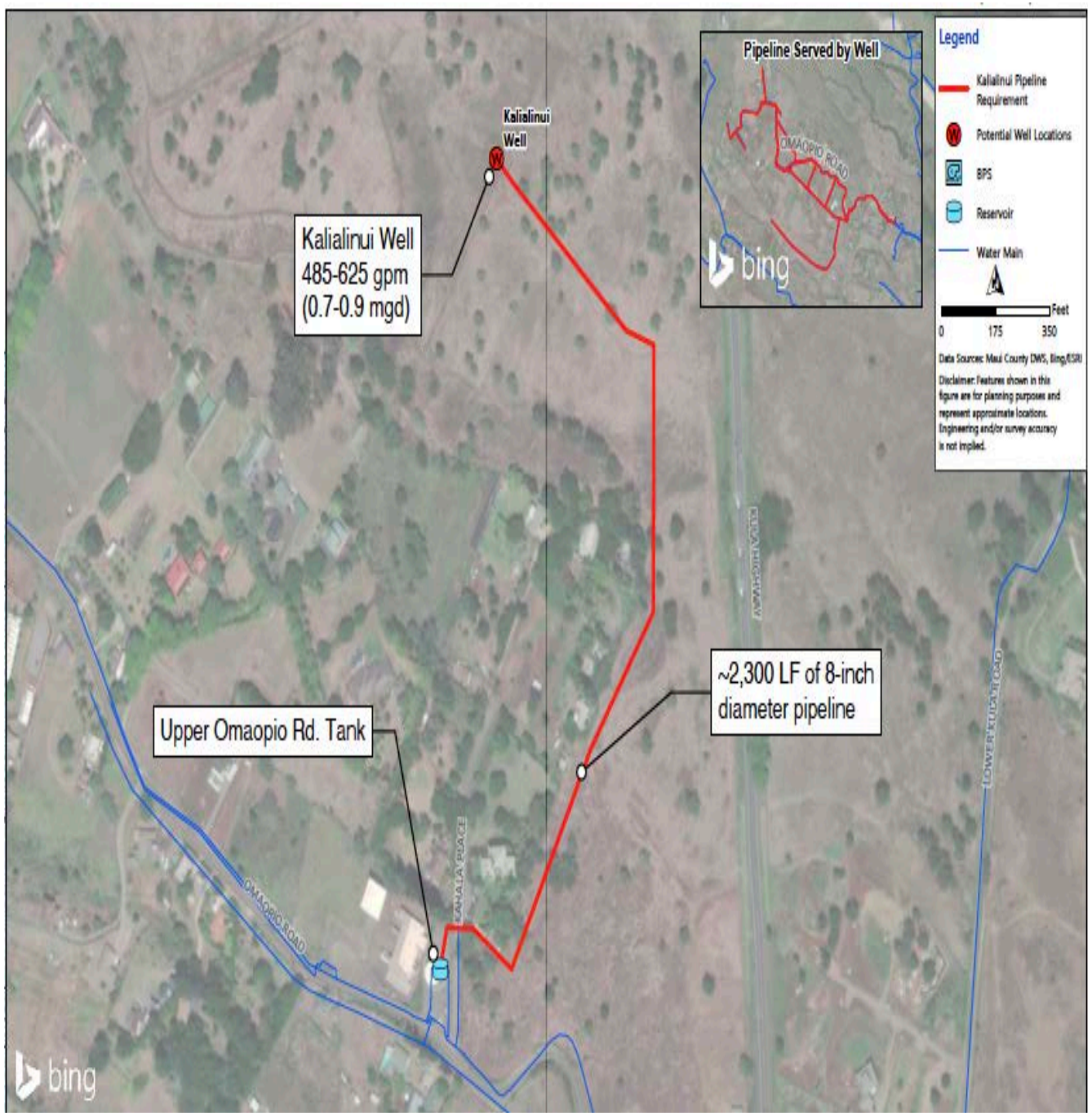
Hoku Nui Well Attributes

- Well completed. Pending testing and agreement with owner.
- Expected production – 1.15 MGD (16-hour day)
- Initial evaluation – suitable location for new well, Makawao aquifer has capacity.
- Connection to County System - includes 6,100 feet of piping and a one-million-gallon storage tank, connection to Pookela Tank, feeds Makawao system, existing users would become DWS customers.
- HECO and solar – requires additional power, HECO is available nearby, land available for solar.
- Timing – requires purchase and development of connecting infrastructure.
- Cost – purchase in negotiations, require up-front funds for purchase and connecting infrastructure, purchase eligible for GET funds.

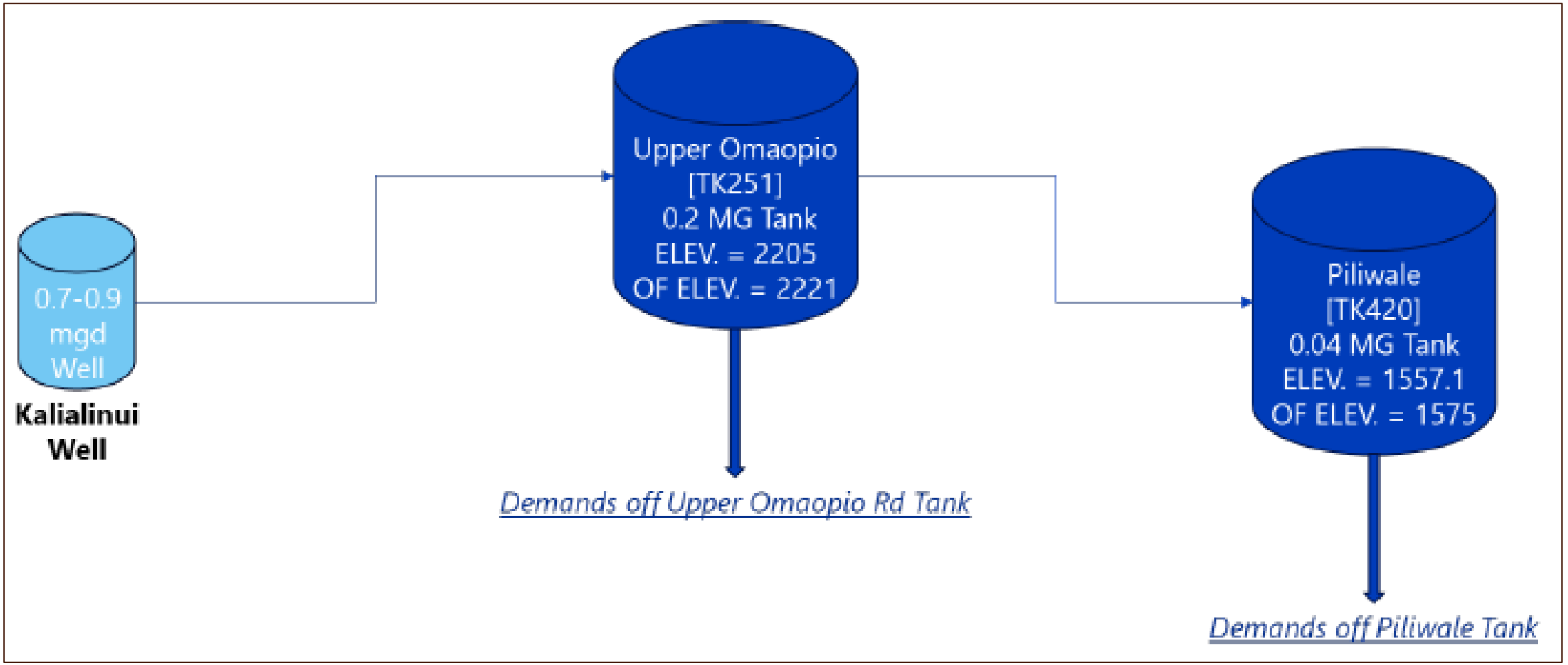
Pi’iholo Well Attributes

- Second priority because of proximity to other wells.
- Expected production – 0.67 MGD (16-hour production).
- Initial evaluation – suitable location for new well, possible quality issues, Makawao aquifer has capacity.
- Connection to County System – requires coupling with Hokunui well to be cost effective.
- HECO and solar – HECO is available nearby, possible power capacity concerns.
- Timing – requires purchase and development of connecting infrastructure, strategy is to wait until Hokunui is deemed acceptable.
- Cost – lease, require up-front CIP for connecting infrastructure.

Kalialinui Well



Schematic of Kalialinui Well



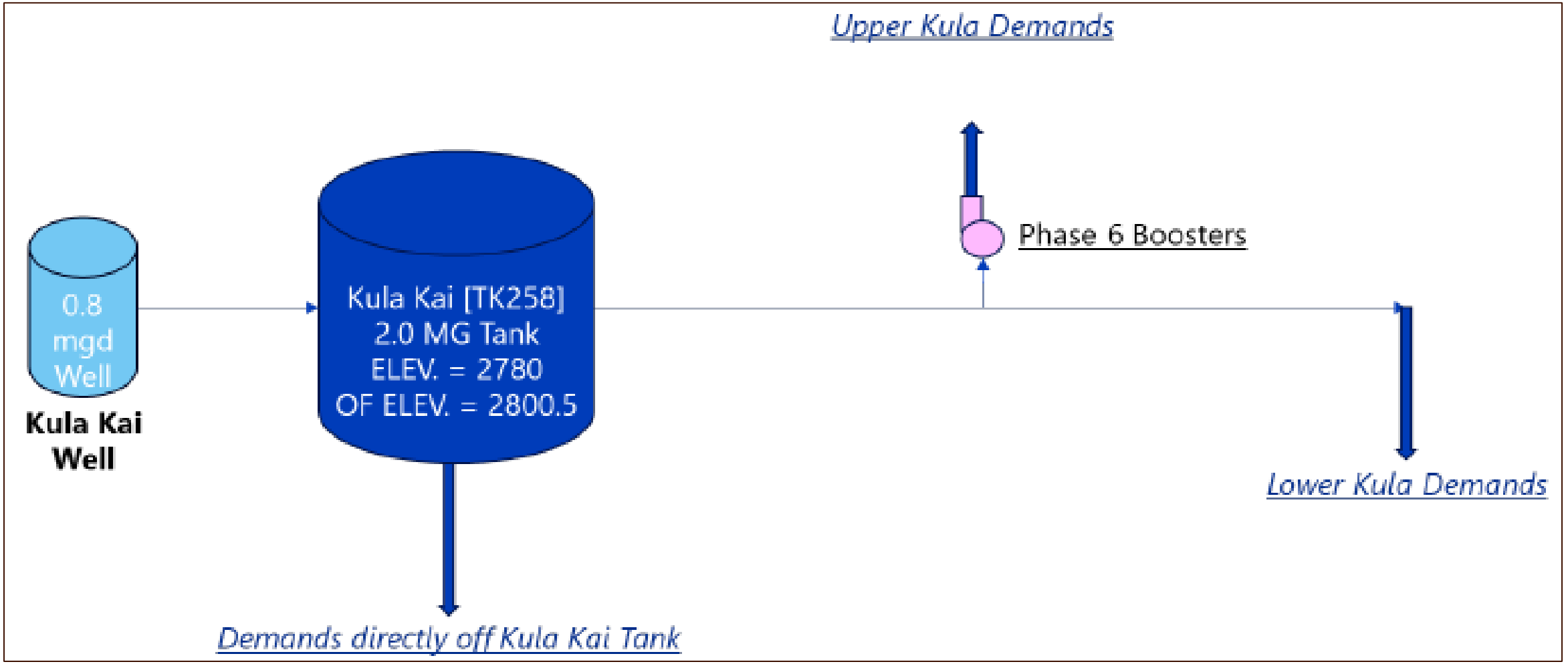
Kalialinui Well

Kalialinui Well Attributes

- Well completed. Pending testing and agreement with land-owner.
- Expected production = 0.96 MGD (16-hour production).
- Existing well, potential for second well on site.
- Connection to Upper Omaopio Road Tank – requires 2,300 feet of pipeline.
- Will alleviate demand from Kula Kai Tank.
- HECO and solar – HECO nearby, land available for solar.
- Timing – requires lease and development of connecting infrastructure.
- Cost – lease in negotiations, requires up-front CIP for connecting to infrastructure.

Kula Kai Well

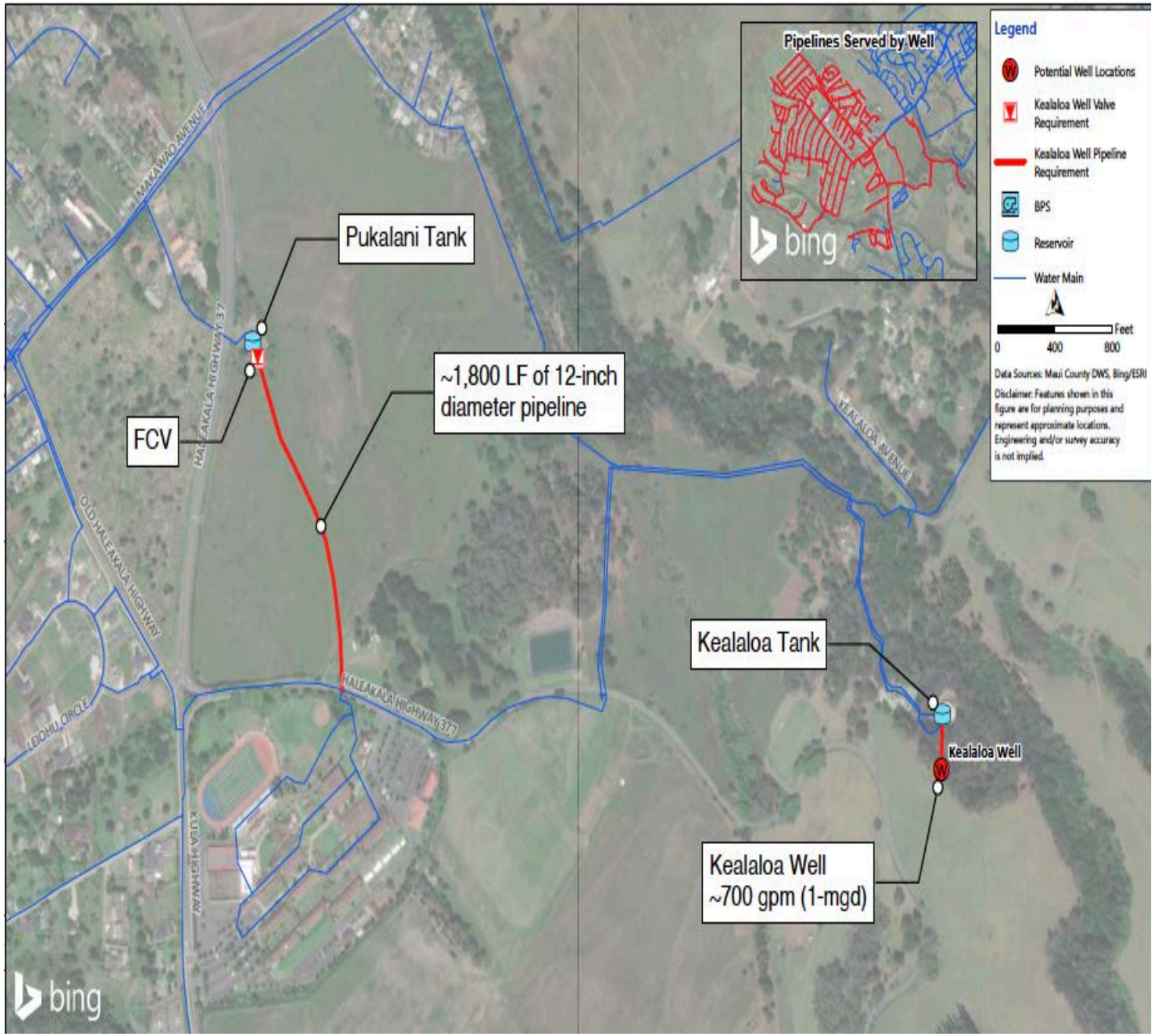
Schematic of Kula Kai Well



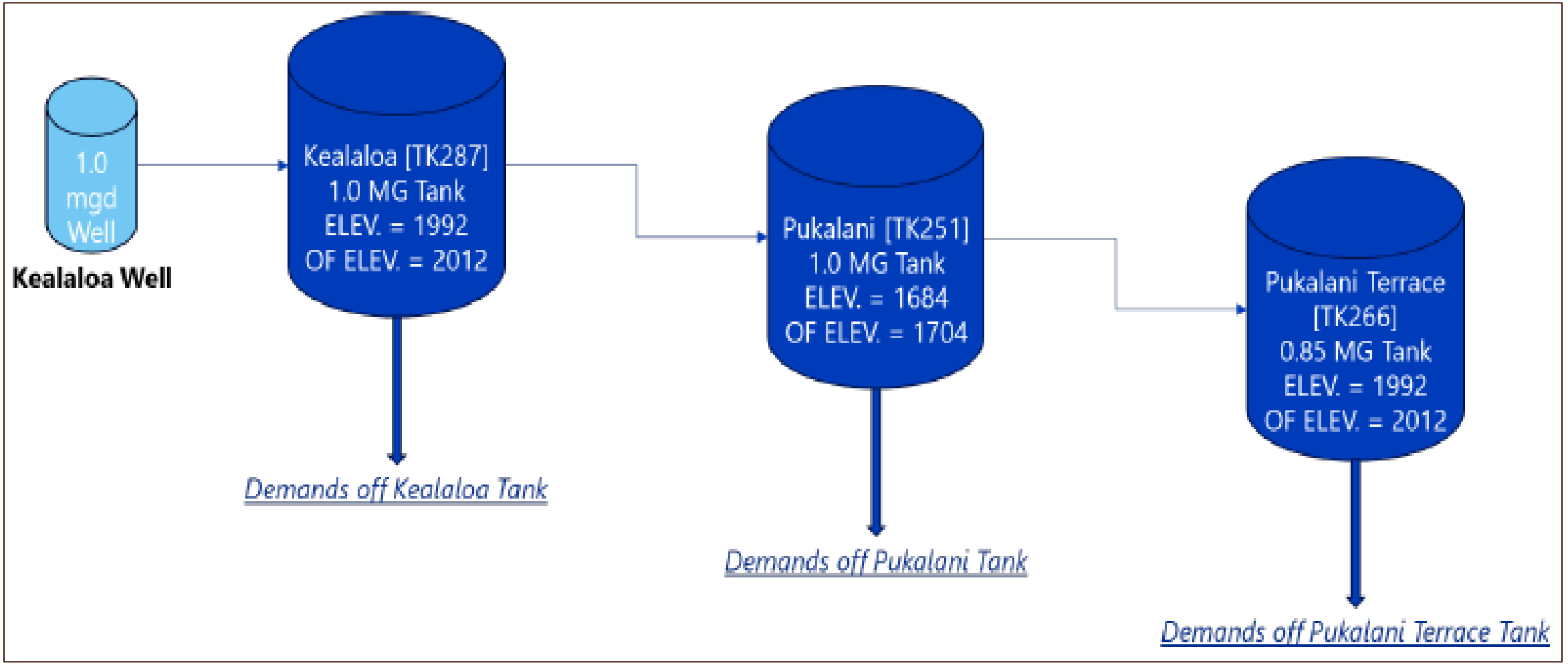
Kula Kai Well Attributes

- Acquire property from Haleakala Ranch and drill well.
- Expected production = target 0.96 MGD (16-hour production)
- Initial hydraulic evaluation – excellent location, in Makawao Aquifer
- Connection to County System – outstanding location, minimal infrastructure to Kula Kai Tank and Booster Station.
- HECO and solar – easy access to HECO and land for solar.
- Timing – requires land acquisition, included in FY26 budget for exploratory phase, need well drilling permit, need environmental assessment.
- Cost – estimated at $20M

Kealaloa Well



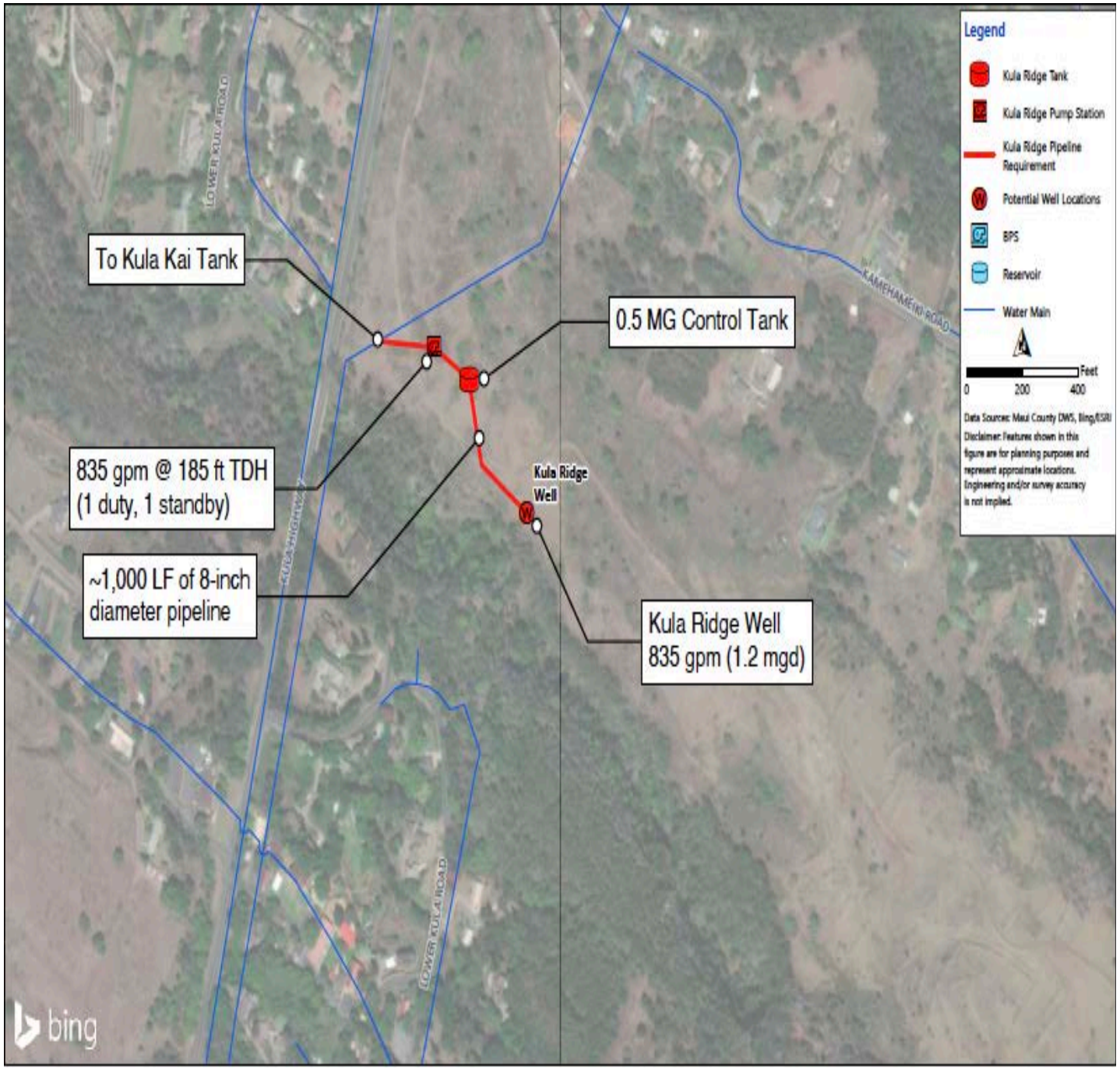
Schematic of Kealaloa Well



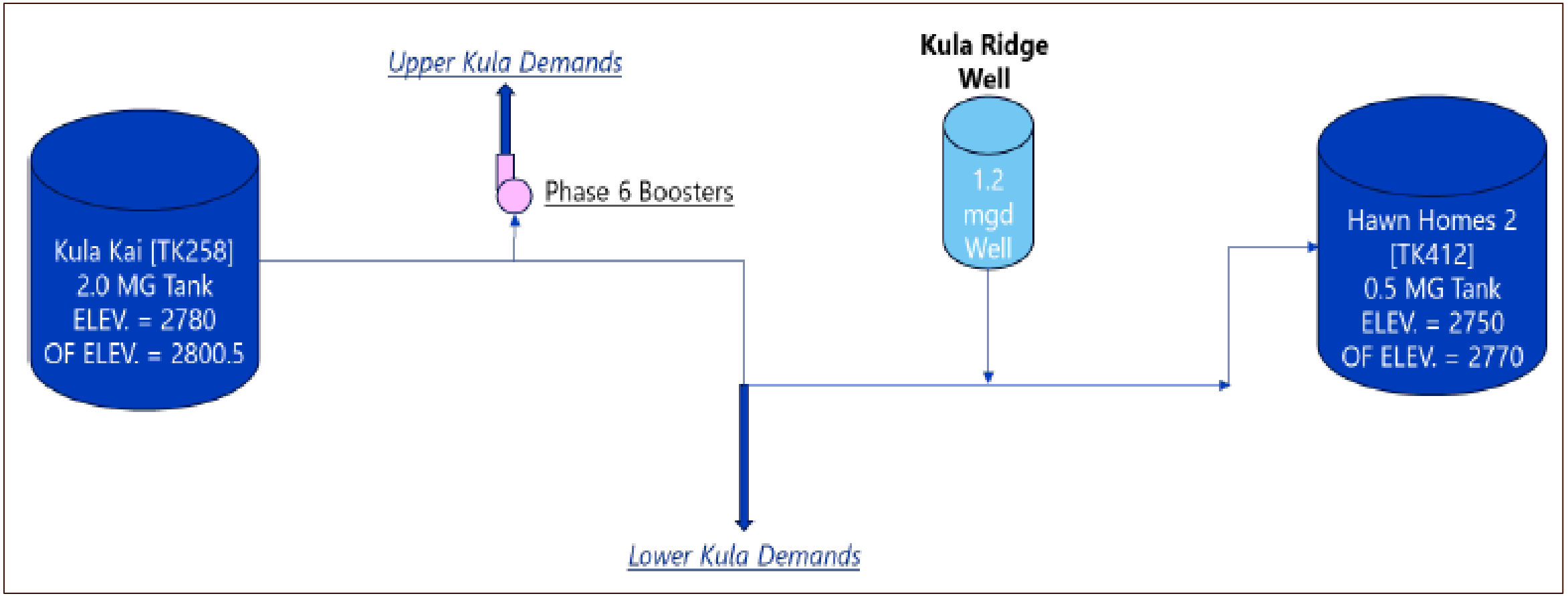
Kealaloa Well Attributes

- Partnership with DLNR.
- Expected Production – 0.96 MGD (16-hour production)
  - MOU anticipated to allocate 75% to County.
- Connection to County System – connection to Kealaloa Tank, minimal infrastructure, distribution improved by connecting to Pukalani Tank requiring 1,800 feet of pipeline.
- Hydrogeology – initial evaluation positive
- HECO and solar – HECO relatively close, minimal land for solar.
- Timing – DLNR has completed the exploratory phase and is in the design phase.
- Cost – The remainder is expected to be paid by DWS, estimate $15M.

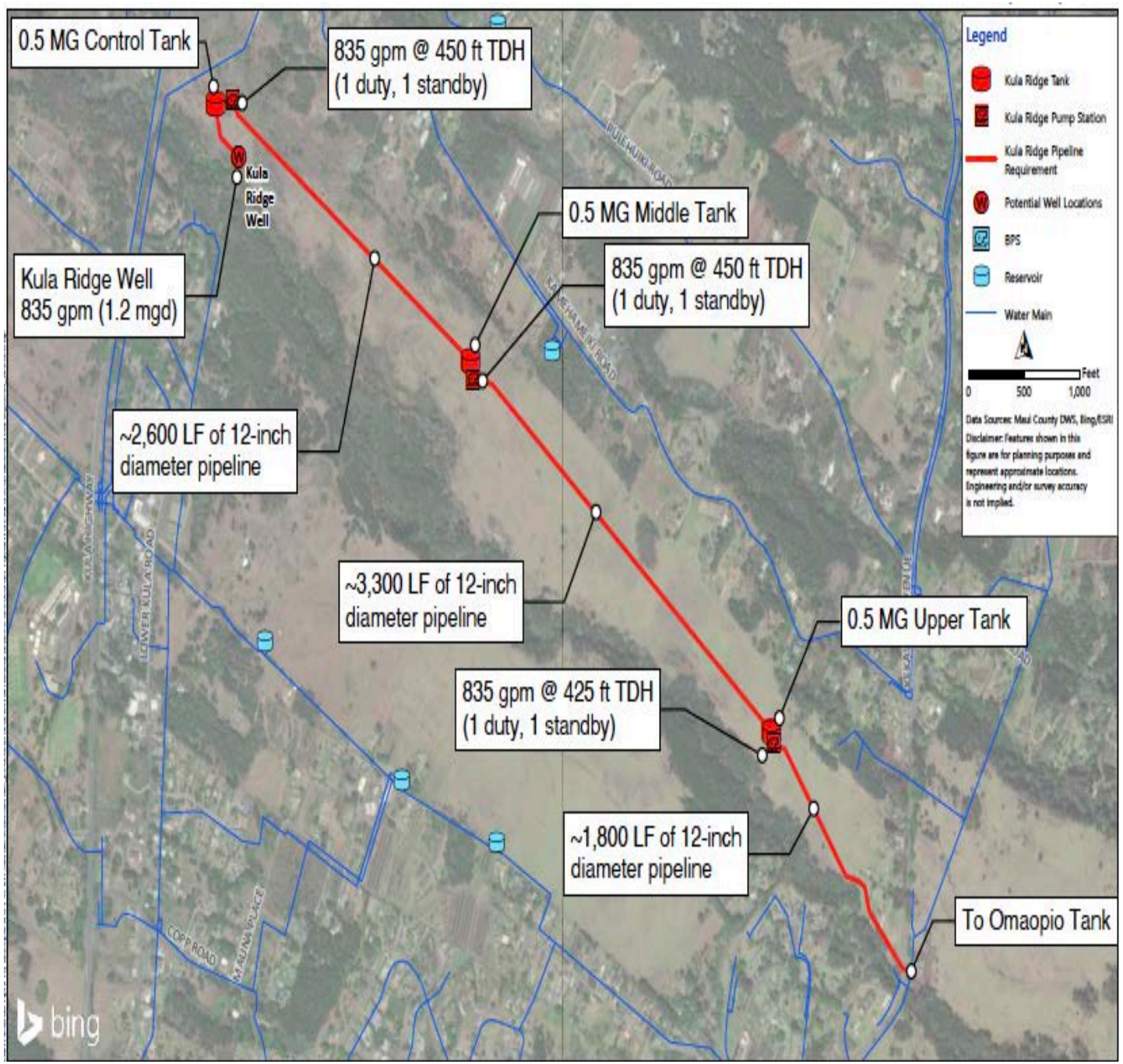
Kula Ridge Well (Lower System)



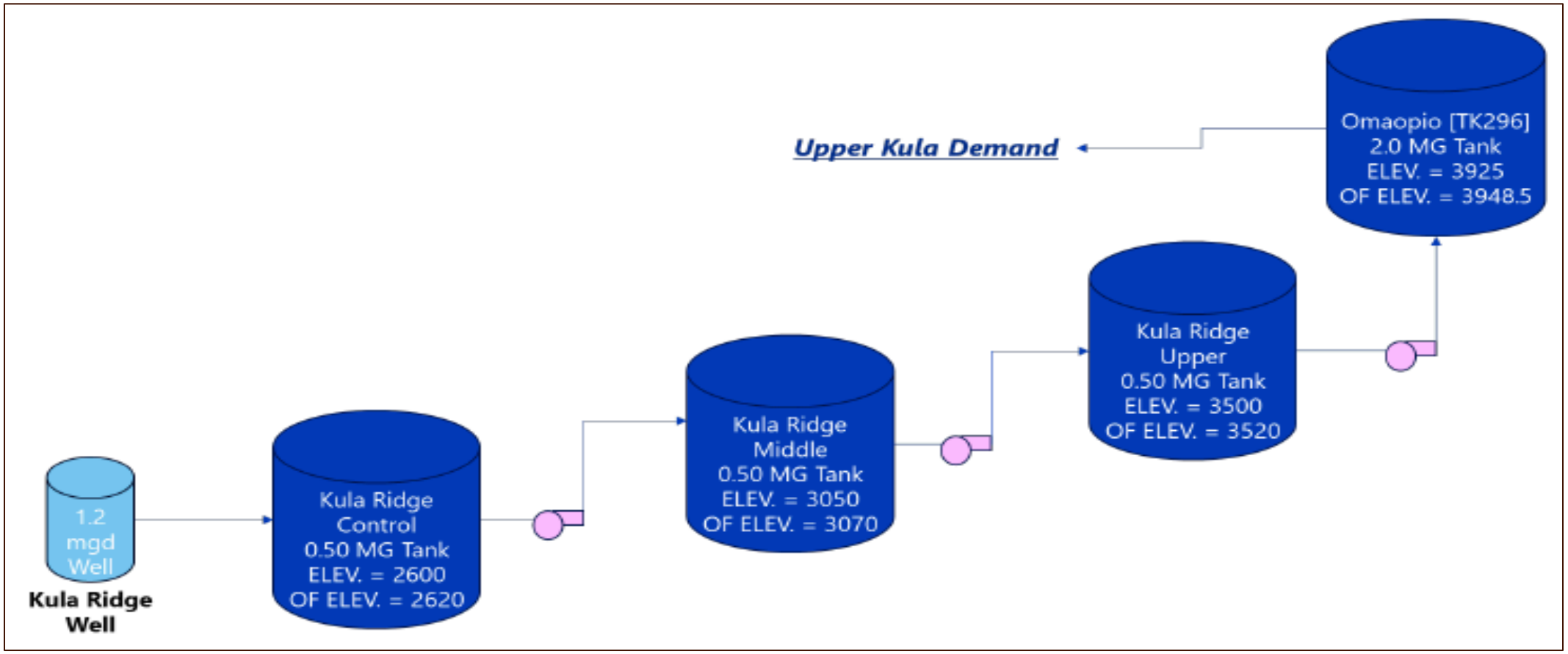
Schematic of Kula Ridge Well (Lower System)



Kula Ridge Well (Upper System)



Schematic of Kula Ridge Well (Upper System)



Kula Ridge Well Attributes

- County owned land.
- Estimated production = 0.96 MGD (16-hour production), option for multiple wells
- Connection to County System – direct connection to Kula Kai Tank, Lower Kula Transmission Line, approximately 1,000 feet of pipeline, possible boost to Upper Kula Transmission line with a useful interconnect, space for tanks and reservoirs.
- Initial hydrogeologic evaluation – requires a deep well.
- HECO and solar – HECO requires significant power system improvements, room for solar.
- Timing - the discovery of Iwi will require time to address, currently being studied as a CIP project.
- Cost – relatively expensive due to deep groundwater.

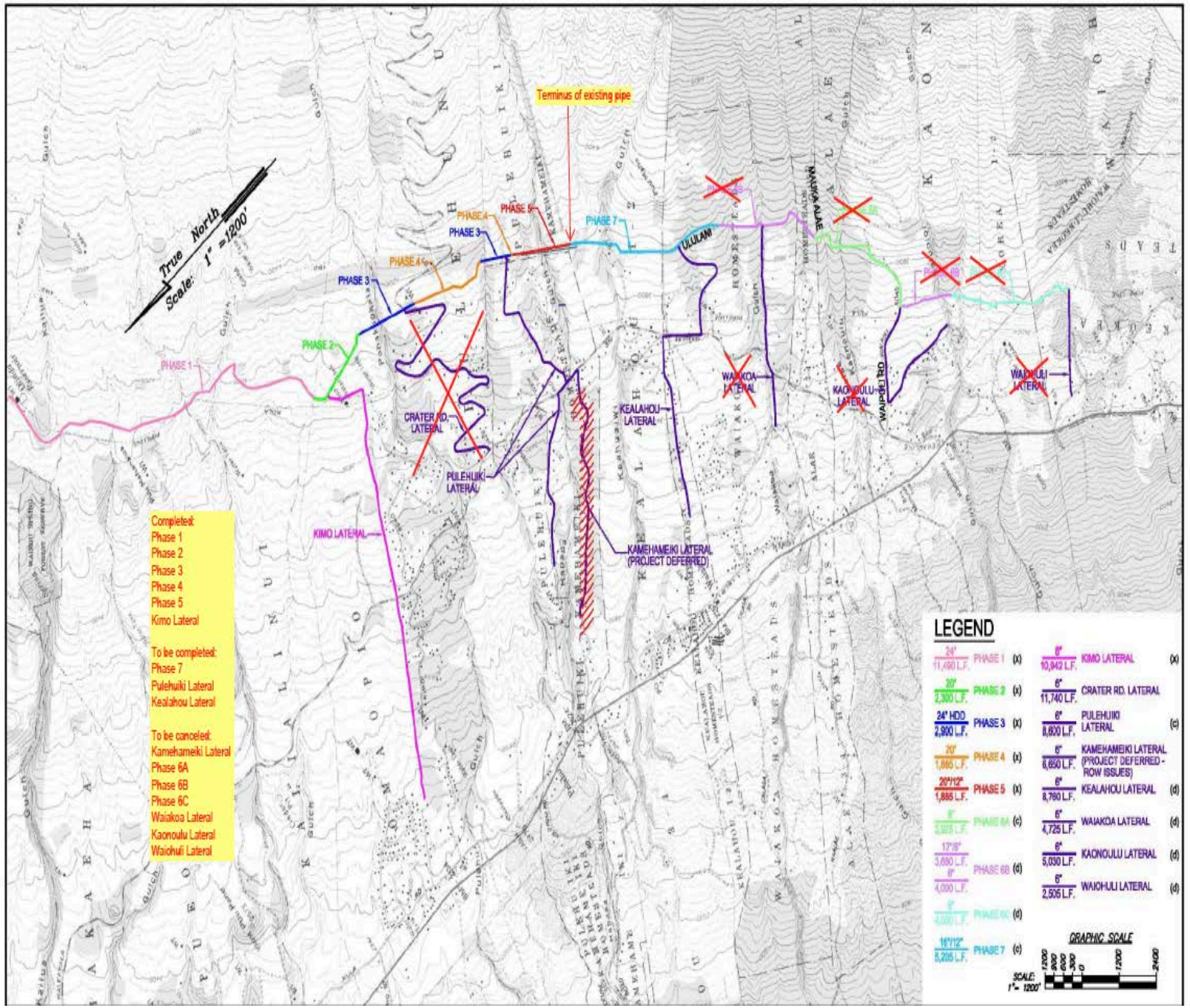
Related Issues

- Existing State Agriculture Line.
- Interconnect to Central System.
- Development of Infrastructure Master Plan.
- Additional Raw Water Reservoirs.
- Additional Potable Water Storage Tanks.
- Coordinating with East Maui Water Authority.
- Processing the Meter List.

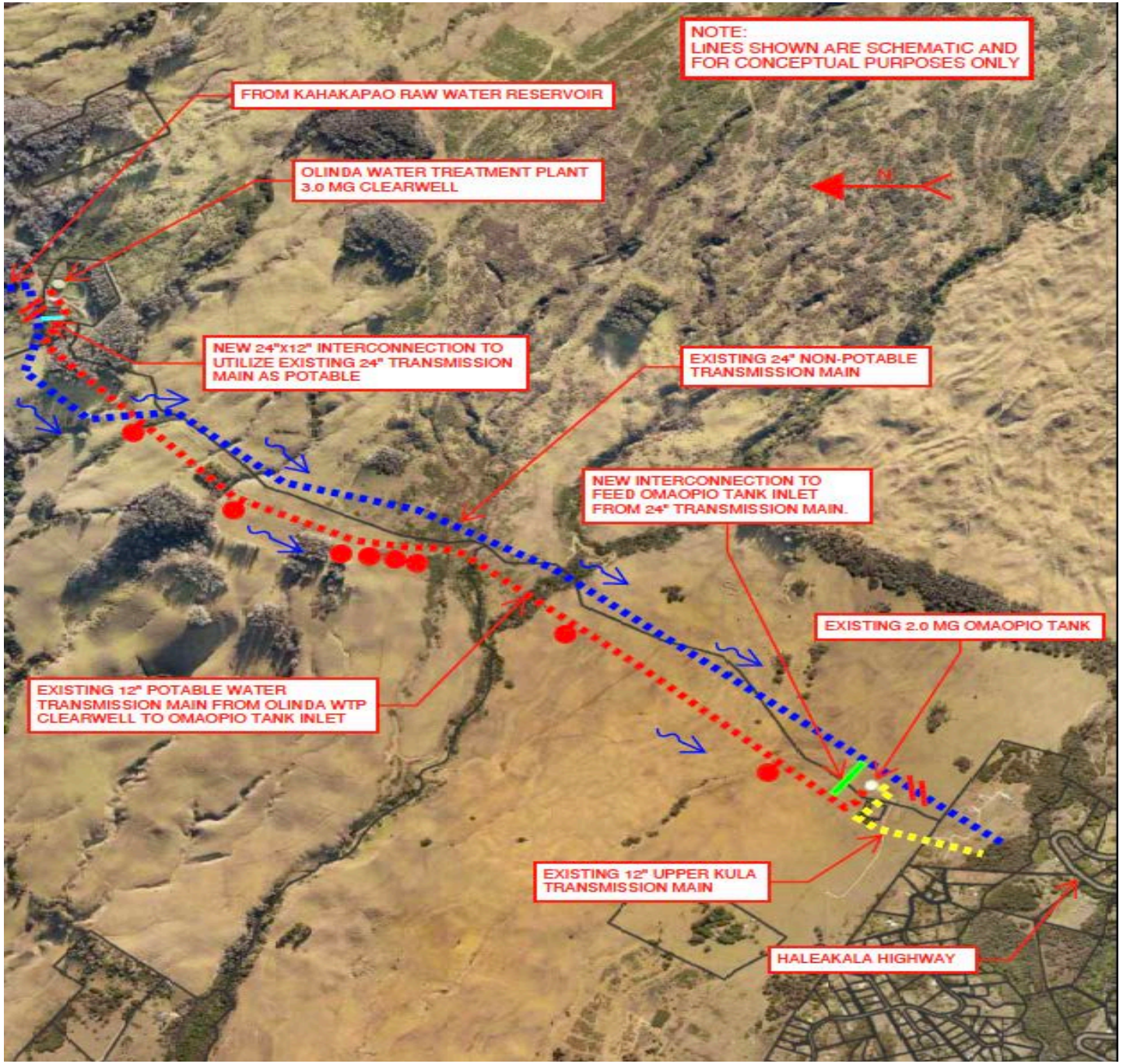
Agriculture Line

- Developed by State.
- Possible use as connection to Olinda Treatment Plant.
- Possible use as alternative Hapapa Gulch Crossing.
- Possible use as transmission line to serve DHHL land.

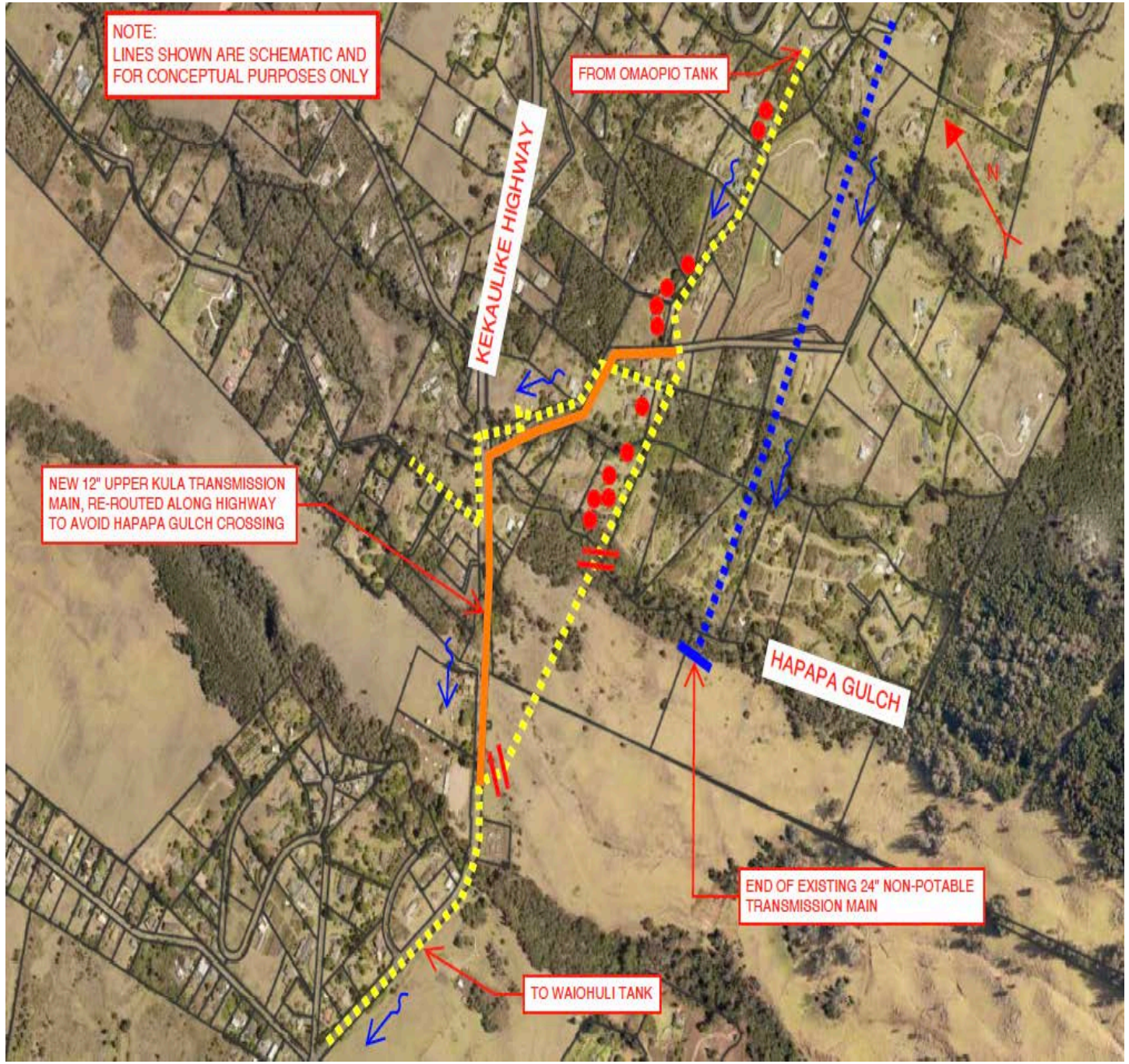
Map of Agriculture Line



Map of Agriculture Line: Olinda Area



Map of Agriculture Line: Hapapa Gulch Area



Interconnect to Central System

- Connecting water systems is beneficial for reliability.
- Evaluation of connection in FY ‘26 CIP.
- Has been controversial in the past.

Map of Interconnect

Infrastructure Master Plan

- Foundation for the infrastructure master plan is hydraulic water model.
- The basis for the CIP
- Will identify system needs.
- Will allow planning for future system expansion.

Raw Water Reservoirs

- Kamole is the top priority.
- Topography is challenging.

Potable Water Storage Tanks

- Priority for fire flow
- Allows operation during power outages.

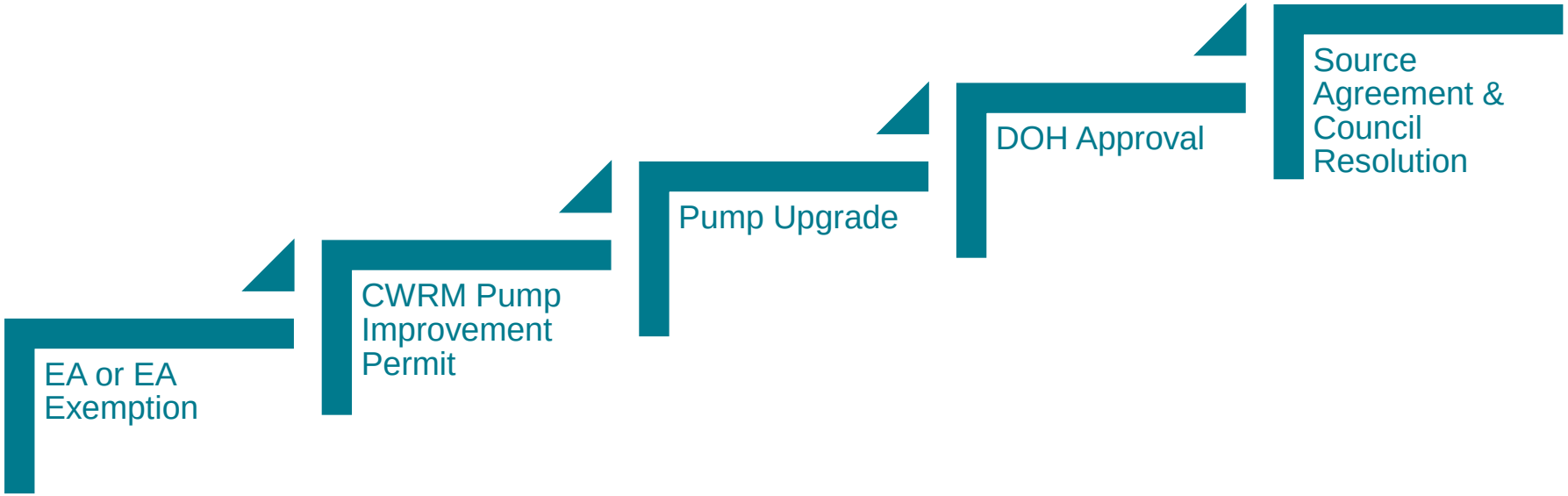
East Maui Water Authority

- The function of managing the surface water in East Maui has been transferred to the EMWA.
- The MDWS is supporting this effort.

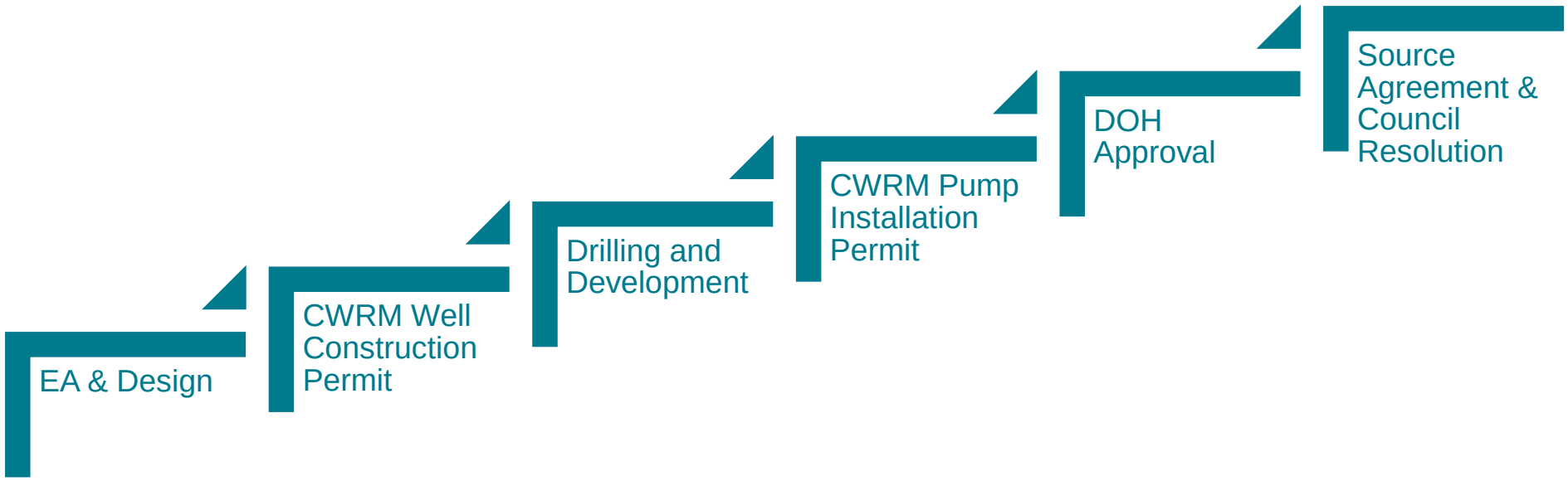
Processing the Meter List

- Currently evaluating options to chronological processing
  - Benefit Districts
  - Easiest first
  - Smallest first
  - Prioritize categories
  - Subregions first
  - Alternatives will be vetted with community
  - Changes will need Council approval

Timeline: Purchase or Lease
1-3 years



Timeline: Construction of New Well
5-10 years



Financing Options

- Pay-as-You-Go
- Revenue Bonds
- GET Funds
- Outside funding

New Existing and Proposed Wells

Proposed Well	Well ID	Planned Capacity (GPM)	Planned Capacity (MGD)	Estimated pumpage (16-hr day) (MGD)	Notes
Kalialinui	6-4819-001	1000	1.44	0.96	Well completed. Pending testing and agreement with owner.
Hoku Nui	6-5118-004	1200	1.73	1.15	Well completed. Pending testing and agreement with owner.
Pi‘iholo	6-5118-003	700	1.01	0.67	Second priority because of proximity to Hoku Nui and Po‘okela Wells.
Kealaloa Tank	6-4918-001	1000	1.44	0.96	Partly funded by DLNR.
Kula Kai Tank	Planned	1000	1.44	0.96	Good site on MDWS land.
Kula Ridge	Planned	1000	1.44	0.96	Good site on County land.
TOTAL			8.50	5.66	If all six wells are pumped, the SY will be exceeded.
TOTAL FOR 4 WELLS			6.05	4.03	Assume 2 wells will not be developed.

Summary of New Sources

Source	Acquisition Type	Million-Gallons-per-Day
Kamole Filter Upgrade	DWS Project	1.50
Kamole Source Increase	Agreement	2.50
Hokunui Well	Acquisition	1.15
Kalialinui Well	Lease	0.96
Kealaloa Well	Partnership	0.72 (also 0.24 to DHHL)
Kula Kai Well	DWS Drill	0.96
Kula Ridge Well	DWS Drill	0.96
Pi'iholo Well	Lease (secondary priority)	0.67
ALL PROPOSED WELLS		5.42
SY LIMIT		4.00
Available to MDWS		**7.76 (1.5+2.5+4.0-0.24)**

It is understood that the six wells will exceed the Sustainable Yield (SY).
If all six are brought into service, then some will be managed as backup.

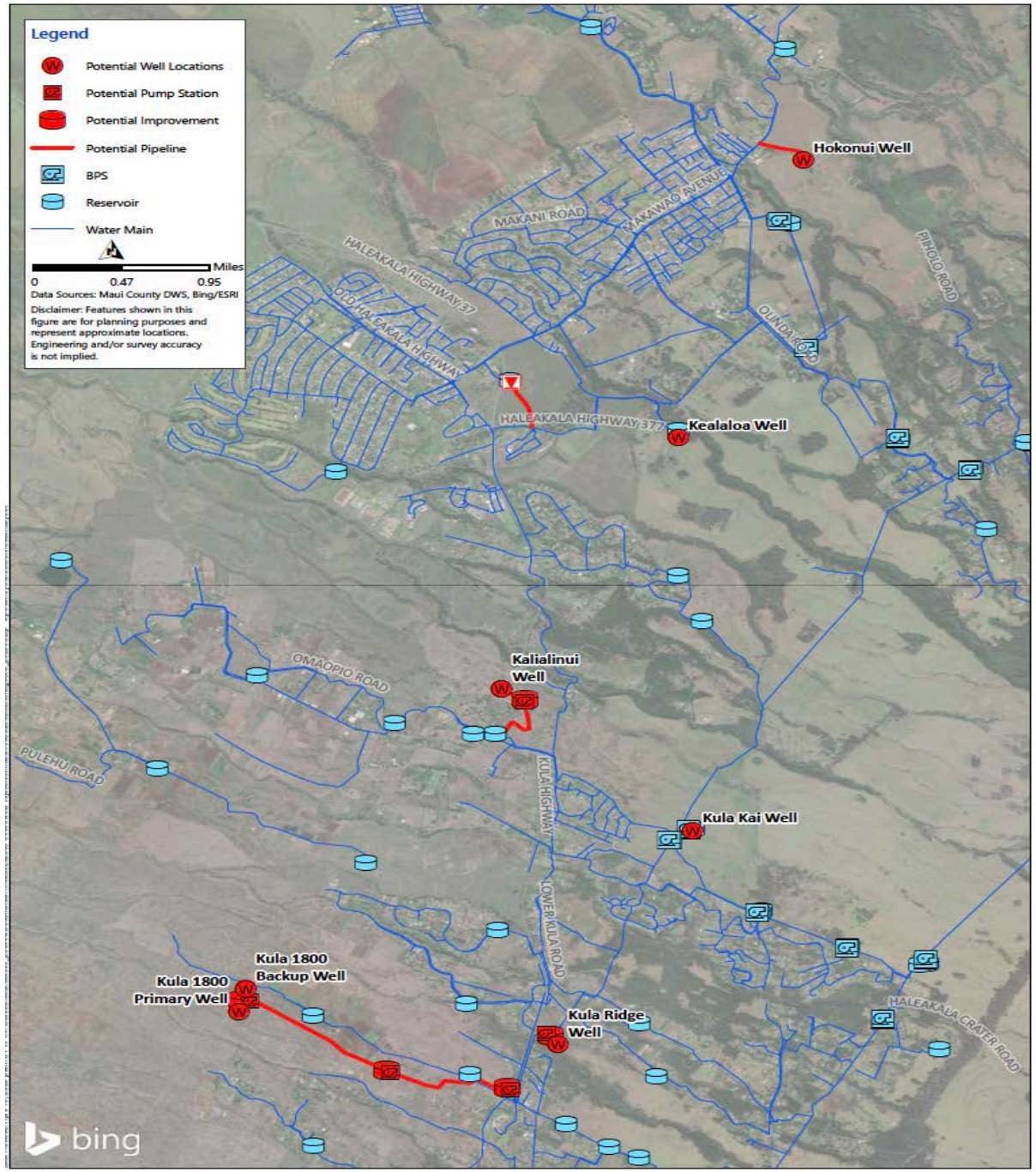
Summary

- Peak Demand (including inactive meters) = 10.1 MGD
- Demand with Meter List = 10.1 + 2.2 = 12.3 MGD
- Demand for Build Out = 12.3 + 4.5 = 16.8 MGD

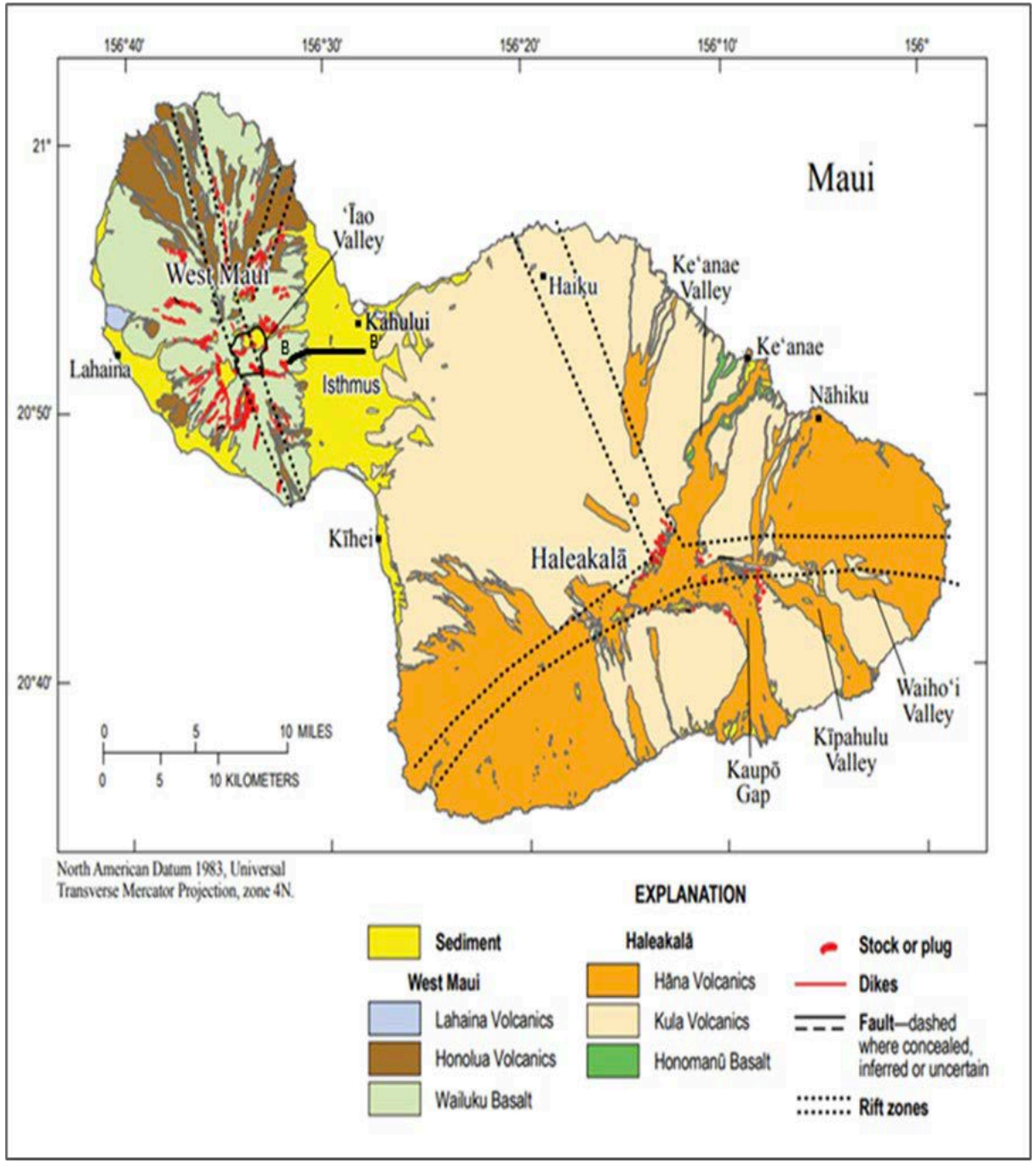
- Current Reliable Capacity = 9.7 MGD
- With Kamole Filter Addition = 9.7 + 1.5 = 11.2 MGD
- With Kamole Source Addition = 11.2 + 2.5 = 13.7 MGD
- With All Proposed Wells = 13.7 + 4.0 = 17.7 MGD (limited by SY)

Pocket Slides

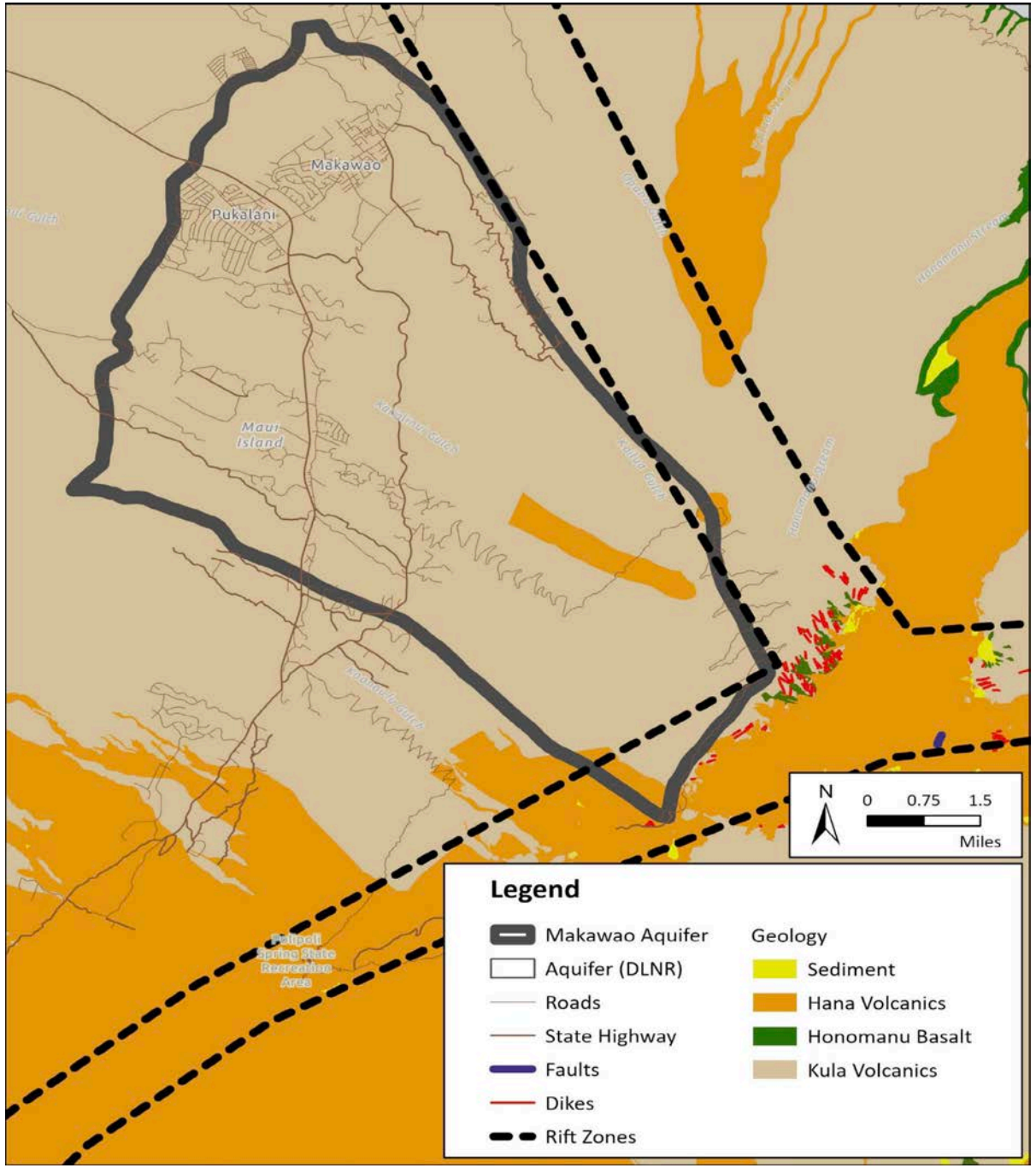
Well Locations



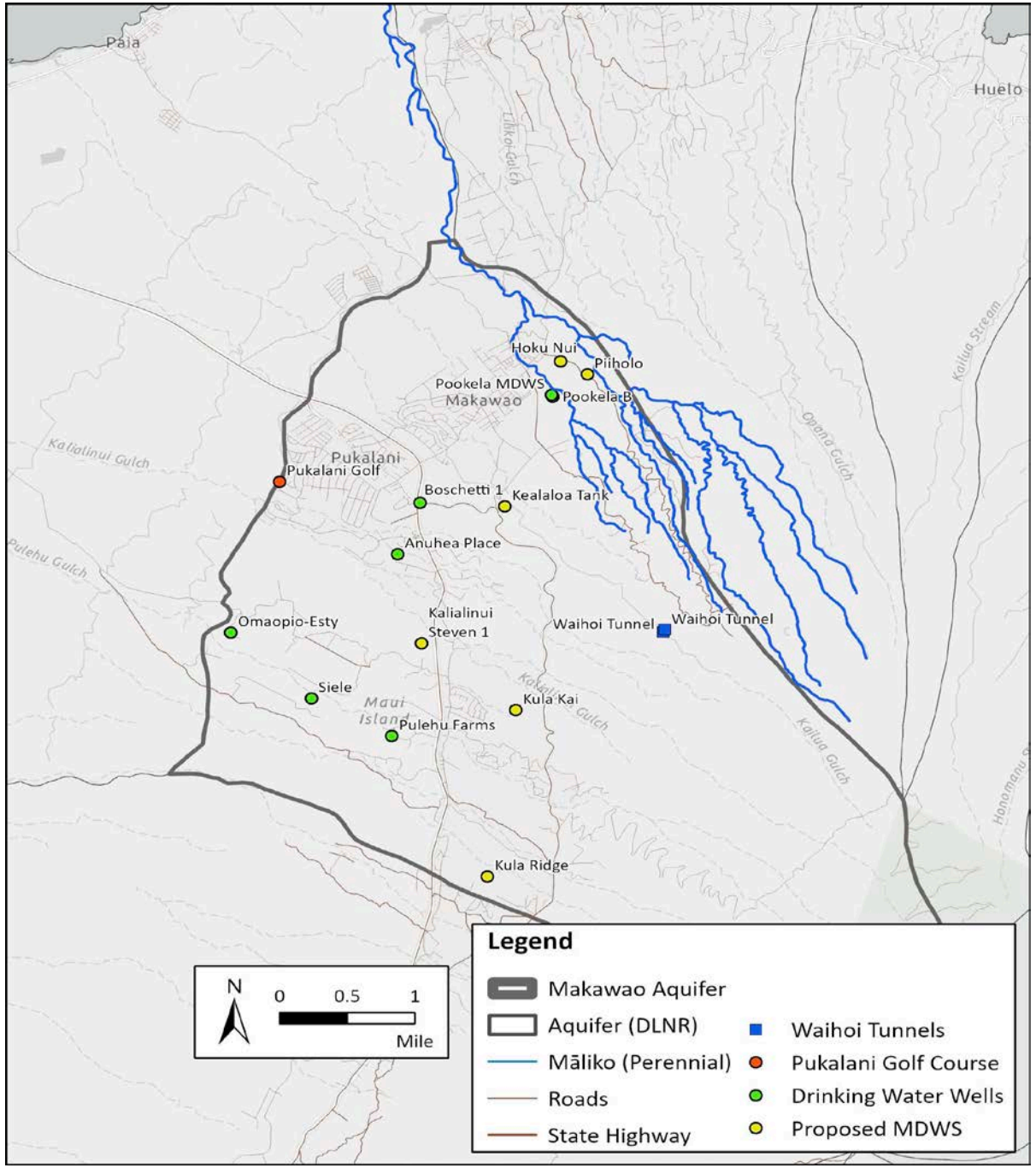
Surficial Geology of Maui



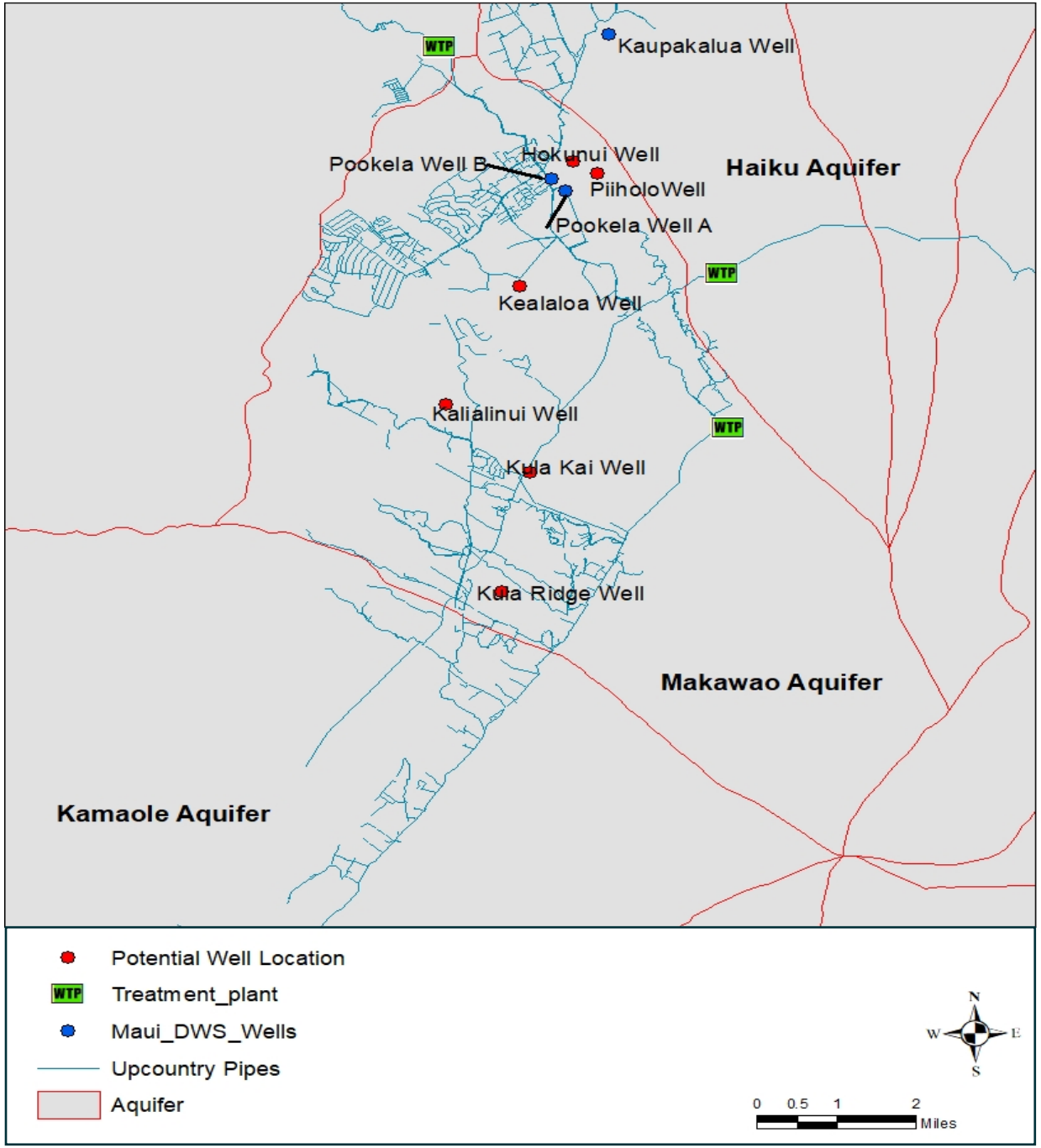
Geology of Makawao Aquifer System



Perennial Streams in the Makawao Aquifer



Map of Existing and Proposed County Wells



Makawao Pumpage

The largest water user in the Makawao Aquifer System other than DWS is the Pukalani Golf Course. Withdrawals vary seasonally, with some months reporting zero withdrawals, and other months reporting on average over 0.5 MGD.

Hāliʻimaile Well was pumped at over 0.1 MGD between 2005 and 2009 but for the most part they have discontinued pumping.