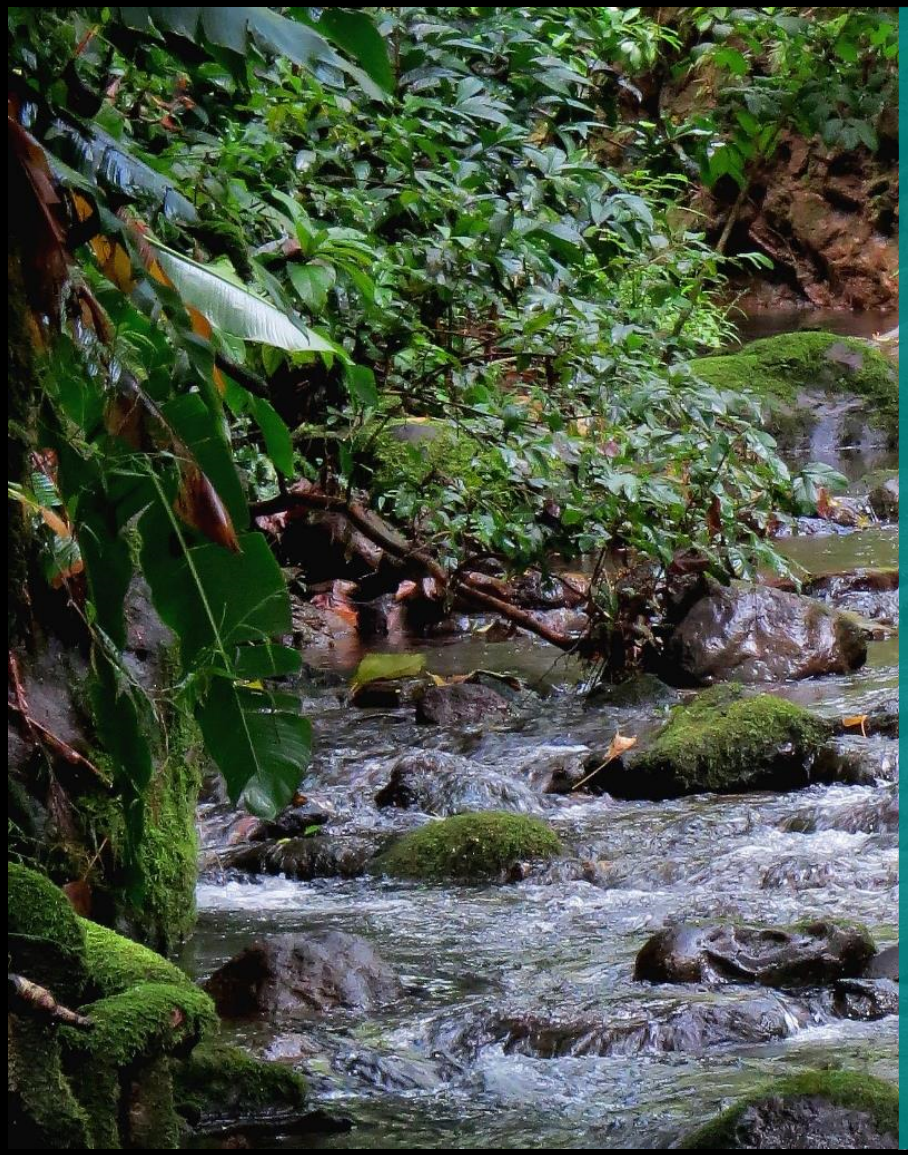


STAKEHOLDER ADVISORY GROUP

Board of Water Supply, City & County of Honolulu
January 16, 2025
Meeting 53

WELCOME & INTRODUCTIONS

DAVE EBERSOLD, FACILITATOR

STAKEHOLDER ADVISORY GROUP MEETING 53

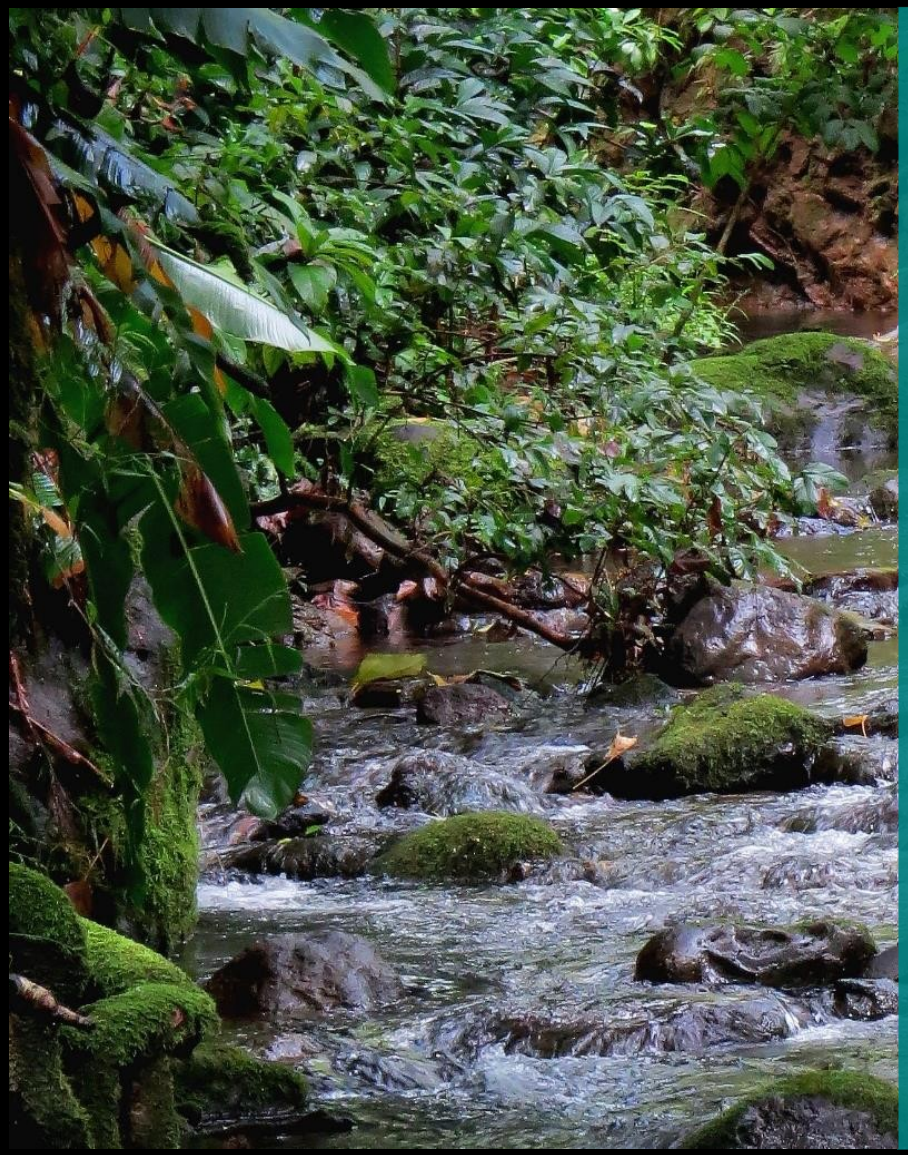
JANUARY 16, 2025

WELCOME NEW STAKEHOLDER!
KALEO MANUEL
DIRECTOR OF WATER RESOURCES AT
KAMEHAMEHA SCHOOLS AINA PAUAHI
REPRESENTING HAWAIIAN CULTURAL

MEETING OBJECTIVES

- Welcome
- Public comment
- Provide landfill overview and update
- Review climate change impacts & approach for Water Master Plan
- Provide Red Hill updates
- Accept notes from meeting #52
- Review 2025 meeting dates

PUBLIC COMMENT ON AGENDA ITEMS



OAHU'S GROUNDWATER AQUIFER AND SITING NEW LANDFILL

Ernest Lau
Manager and Chief Engineer

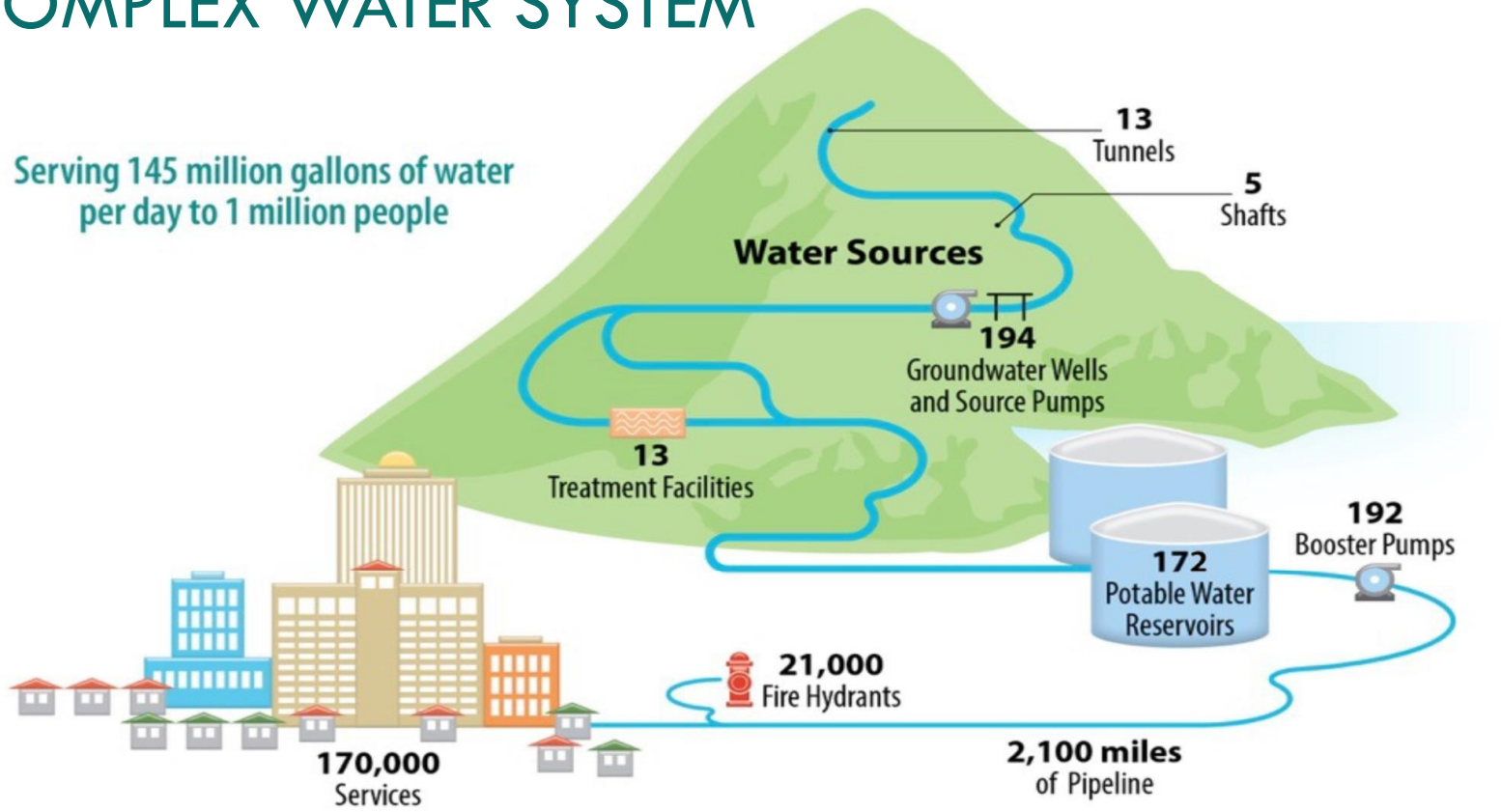
January 16, 2025

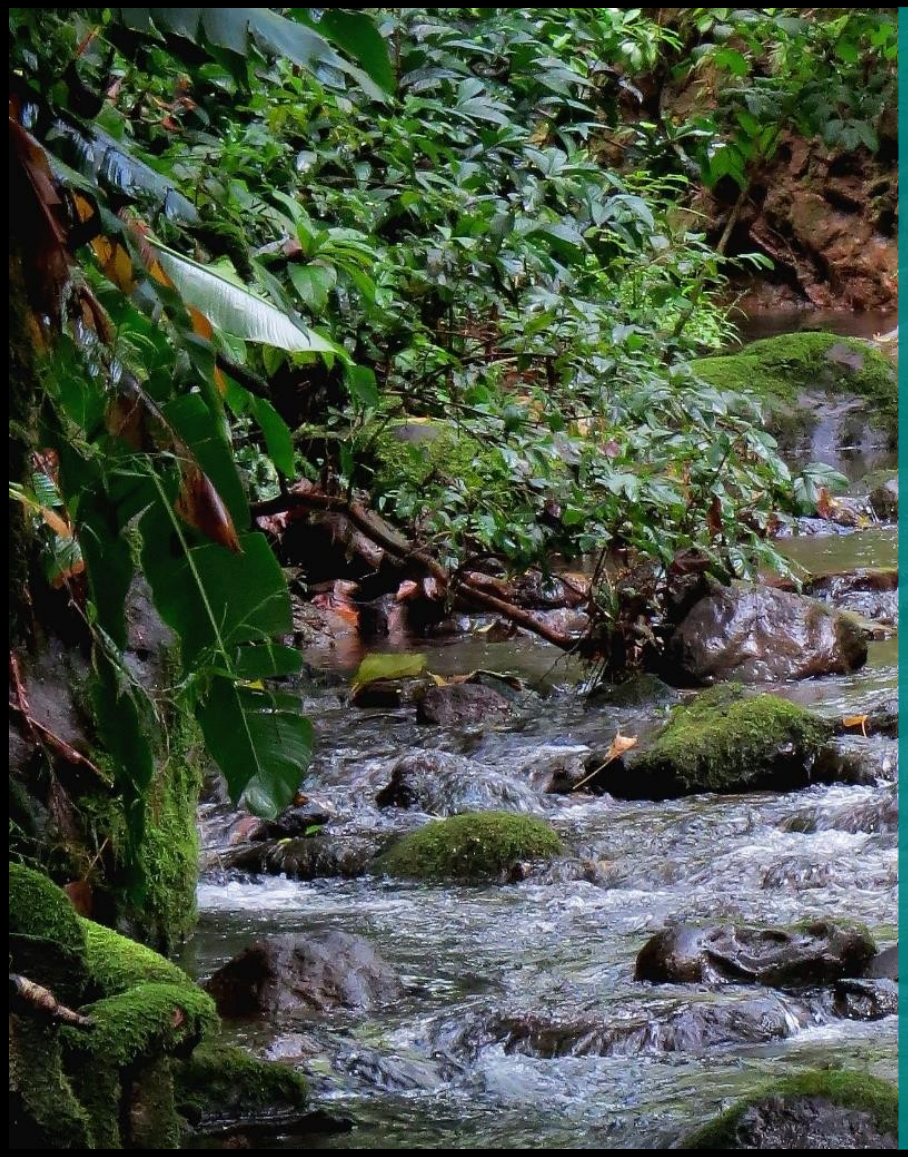
boardofwatersupply.com

KA WAI OLA

WATER FOR LIFE

DELIVERING WATER FROM UNDERGROUND WATER SOURCES TO YOUR HOME REQUIRES A LARGE AND COMPLEX WATER SYSTEM





CITY REQUEST FOR BWS POSITION ON SITING NEW LANDFILL

boardofwatersupply.com

CITY REQUEST FOR BWS POSITION ON 6 LANDFILL SITES

DEPARTMENT OF ENVIRONMENTAL SERVICES
CITY AND COUNTY OF HONOLULU
1000 ULUOHIA STREET, SUITE 308, KAPOLEI, HAWAII 96707
TELEPHONE: (808) 768-3486 • FAX: (808) 768-3487 • WEBSITE: http://envhonolulu.org

RICK BLANGIARDI
MAYOR

ROGER BABCOCK, JR., Ph.D., P.E.
DIRECTOR

MICHAEL O'KEEFE
DEPUTY DIRECTOR

IN REPLY REFER TO:
DIR 22-88

November 3, 2022

SENT VIA EMAIL

Ernest Y. W. Lau, P.E.
Manager and Chief Engineer
Honolulu Board of Water Supply
elau@hbws.org

Dear Ernest:

Thank you for your time and attention during the October 24, 2022, Board of Water Supply (BWS) board meeting. This letter follows up on the item for information, "Briefing by the Department of Environmental Services on their Landfill Siting" that was on that meeting's agenda.

At that meeting we briefed the board that BWS presented on groundwater and landfills to the Landfill Advisory Committee (LAC) and the LAC, based on BWS' presentation, despite evaluating and ranking six sites did not recommend any of the six sites as an alternative to the existing landfill (please see attachment A for final report).

Given this sequence of events, at the October 24 BWS board meeting, I requested clarity on BWS' legal authority over landfill siting and whether that authority was exercised, and if not exercised, when the City should seek a determination.

In order to clarify BWS' position and due to the impending deadline set by the State Land Use Commission Decision and Order for the Department of Environmental Services to "identify an alternative landfill site that may be used upon closure of WGSL [Waimanalo Gulch Sanitary Landfill]" by December 31, 2022, I am writing this letter to formally ask for BWS' official position on the six potential landfill sites (please see attachment B for details on those six sites) the LAC evaluated. Specifically, were Mayor to select any of the six ranked sites off the LAC's list, what would be BWS' official response or position?

Given the timeline before us, I would appreciate a response as soon as possible. Please contact me at 768-3486 if you have any questions with respect to the foregoing.

Sincerely,

Digitally signed by O'Keefe, Michael
Date: 2022.11.03 11:33:02 -10'00'

For Roger Babcock, Jr., Ph.D., P.E.
Director

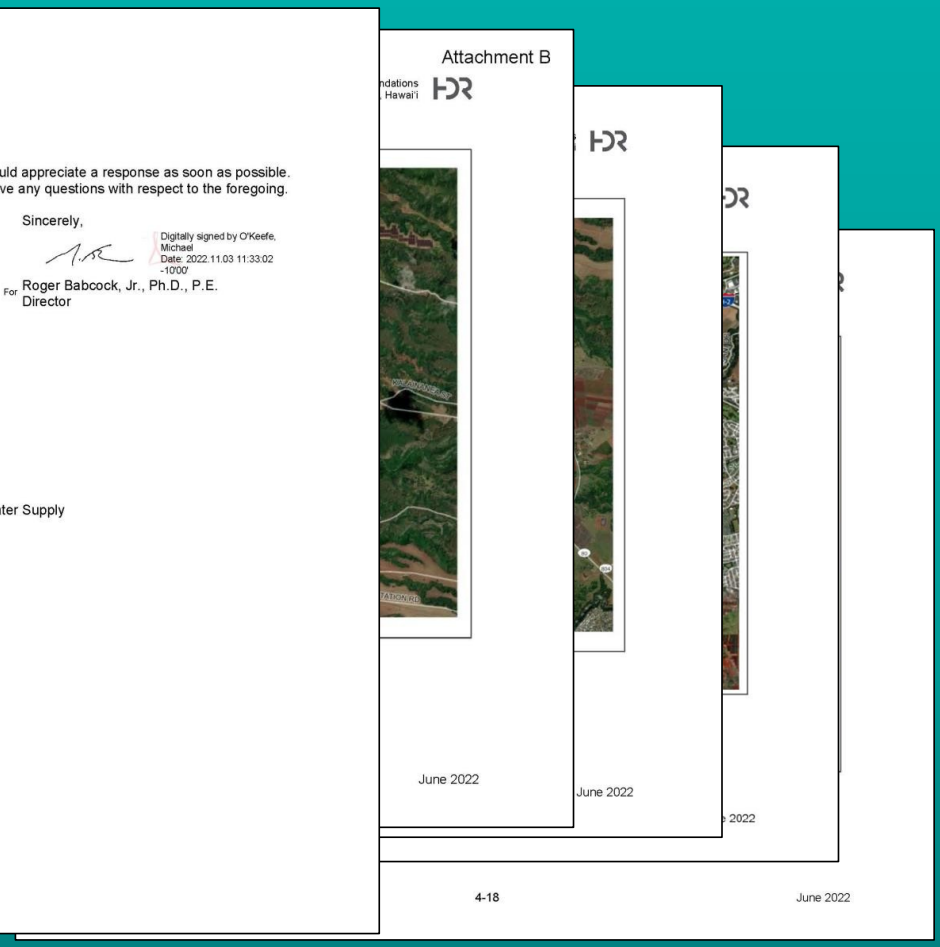
APPROVED:

Digitally signed by Formby, Michael
Date: 2022.11.03 13:59:17 -10'00'

Michael D. Formby, Managing Director
Office of the Managing Director

Attachments: A - LAC Report Here
B - Sites

cc: Rick Blangiardi, Mayor
Brian Andaya, Chair, Board of Water Supply



BWS RESPONSE DISAPPROVING THE 6 LANDFILL LOCATIONS OVER THE DRINKING WATER AQUIFER

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843
www.boardofwatersupply.com

November 16, 2022

Roger Babcock, Jr., Ph.D., P.E.
Director
City and County of Honolulu
Department of Environmental Services

Dear Dr. Babcock,

Subject: Response to November 3, 2022 Letter Regarding the Board of Water Supply's Official Position on the Six Potential Landfill Sites

The Honolulu Board of Water Supply (BWS) is in receipt of your November 3, 2022 letter, in which the City and County of Honolulu Department of Environmental Services (ENV) "formally ask[s] for the BWS' official position on the six potential landfill sites" that were evaluated by the Landfill Advisory Committee (LAC)[1] for possible use upon the closure of the Waimanalo Gulch Sanitary Landfill and "clarity on BWS' legal authority over landfill siting."[2] For the reasons set forth below, the BWS does not approve any of the six proposed landfill sites that are located above (or mauka) the No Pass Zone and over Oahu's drinking water aquifer system.

The Board of Water Supply's Legal Authority Concerning Plans Proposing Waste Disposal Facilities

Safeguarding Oahu's water supply from sources of potential contamination is not a matter of discretion; it is constitutionally mandated. The Hawaii Constitution guarantees that "[a]ll public natural resources are held in trust for the benefit of the people" and directs the State, and by extension the BWS, "to protect, control and regulate the use of Hawaii's water resources for the benefit of its people." Haw. Const. art. XI, §§ 1, 7. As the largest municipal drinking water utility in Hawaii, the BWS has a constitutional public trust responsibility to protect the water resources it manages and to preserve the rights of present and future generations in the waters of Hawaii. *See Kauai Springs, Inc. v. Planning Comm'n of Cnty. of Kauai,* 133 Haw. 141, 171, 324 P.3d 951 (2014) (holding

[1] *See O'ahu Landfill Siting Study & Landfill Advisory Committee Recommendations: Final Report* (June 2022) ("LAC Final Report").

[2] At the October 28, 2022 meeting of the BWS Board of Directors, ENV posed similar questions during an item for information before BWS Board. However, ENV's November 3, 2022 letter is directed to the BWS Manager and Chief Engineer.

'State and its subdivisions shall
mphasis in original)). Specifically,
o maintain the purity and flow of
he waters of our land are put to
nt here, drinking water is among
Water Use Permit Application, 94

ct Oahu's drinking water, the BWS
force rules and regulations having
vention of waste and pollution of
e proper conservation and
city." Revised Charter of the City
54-33). To ensure that
s are protected, the BWS has
facilities, including municipal
ceive written approval from the
Regulations § 3-301(1).

Zones" which generally prohibit
andfills, in areas that may
d to be used for domestic water
s, § 3-301(2).[5] The No Pass Zone
prings that define the areas of thick
ai) the No Pass Zone are primarily
bles the aquifer to replenish within
nt of infiltrated rainwater that falls
o prevent surface contamination
above the No Pass Zone, have no
that is used for drinking water.
plans proposing certain waste
ered and the Manager and Chief
there is any basis to expect that

sibility is "unlimited by any surface-ground
ater. *In re Water Use Permit Applications,*

oward achieving the highest water quality
"shall be liberally interpreted to obtain
§ 174C-2(c).

establish 'No Pass Zones' which … shall
waste disposal facilities. BWS Rules and
ns areas in which the installation of waste
es used or expected to be used for
(emphasis added).

y wastewater therefrom may
ources used or expected to
§ 3-301(2)-(3).

ntial Landfill Sites

WS' No Pass Zone, and all
drogeologically-connected
f this groundwater aquifer
otect it been more
g with what the Hawaii
d environmental disaster"
Fuel Storage Facility that
ly and the pollution of this
s unfortunate environmental
tive in protecting all of our
es of contamination. Oahu's

to the LAC, the BWS
enges associated with finding
esign and engineering can
adversely impact the
valuated by the LAC are
directly over Oahu's drinking
(USGS), citing EPA
nto the environment and that
both old and modern
GS Fact Sheet FS-040-03

do contain a wide range of
ing concentrations—such as
and per- and polyfluorinated
have the potential to

gnated sole-source groundwater
s 77 percent of the total island-
Agency (EPA) determined that
king water" for the island, and that
outhern Oahu Basal Aquifer in the
Fed. Reg. 45496, at 45497 (Nov.

Waimanalo Gulch Sanitary
annually that contains
al dissolved solids
rinking water maximum
dfill leachate
n Oahu in December
leachate at the
charges of municipal
Gulch stream and
roposed landfill sites
that could impact Oahu's

groundwater is always
and impact other parts of
d can move relatively
use of this, contaminant
obust monitoring well
drinking water
esult, contamination from
ndwater aquifer and
it could—as was the
water supply wells in the

hat any landfill sited at
y and/or quantity of the
See BWS Rules and

Sanitary Landfill, Kapolei,
bmitted to the State of Hawaii
f
SWMR_Final.pdf); United
the Destruction and Disposal
Perfluoroalkyl and
er 18, 2020
527-0002_content.pdf);
Leachate PFOA and PFOS
mpleted in Collaboration with
March 6)

f Haw., No 19-224 (D. Haw.
h Honolulu and Waste
v.epa.gov/newsreleases/epa-
analo-gulch.

e consideration of the requisite guidelines and
isapprove all six of the proposed landfill sites above

ed to protect Oahu's drinking water from underground
WS continues to urge ENV to explore new landfill sites
including, where appropriate, requesting additional
ion to explore other siting options.

feel free to contact me at (808) 748-5061.

Very truly yours,

ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

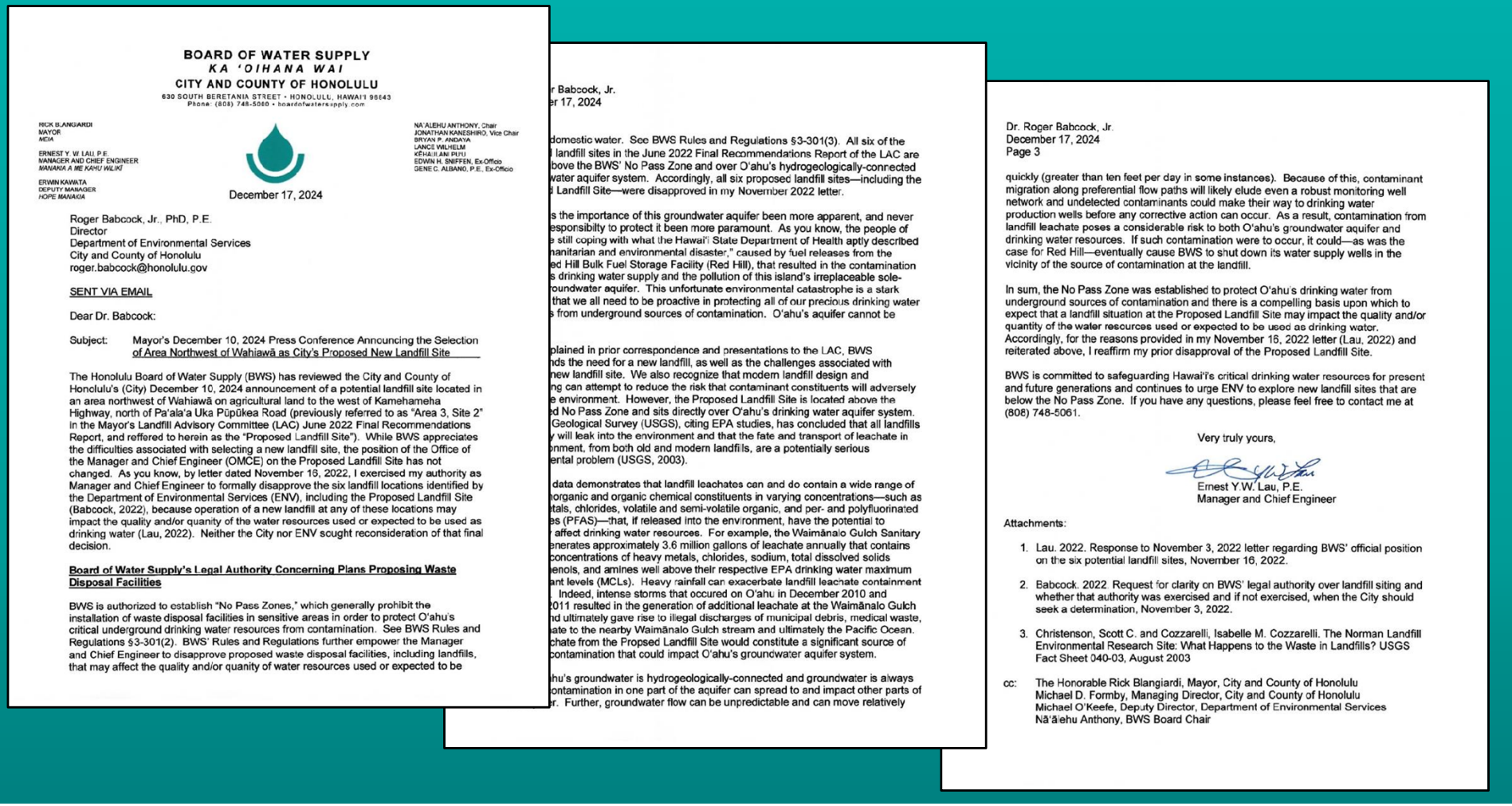
ardi, Mayor, City and County of Honolulu
ing Director, Department of Environmental Services
irector, Department of Environmental Services

nager, BWS

ty of Honolulu agreed when it adopted Resolution 03-09, FD1
Council resolved to establish a policy "of the city that municipal
d anywhere … within the [BWS'] groundwater protection zone, or
rces." This resolution was partially a result of the Council's
chnology that can guarantee that hazardous or other harmful
r the city's aquifer will not, over the long-term, enter the city's
o the public health and welfare of Honolulu's citizens."

its Final Report, specifically noting the importance of the "Board
ecommending any of the final landfill sites. Indeed, "[a]ll LAC
the location of the proposed sites in the No Pass Zone and,
for O'ahu's drinking water resources" (LAC Final Report 1-4) and
ot support a landfill sited within the BWS No Pass Zone due to
n of groundwater resources on O'ahu" (LAC Final Report 6-4).

BWS 2024 RESPONSE REAFFIRMING 2022 DISAPPROVAL



BOARD OF WATER SUPPLY
KA 'OIHANA WAI
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET • HONOLULU, HAWAI'I 96843
Phone: (808) 748-5060 • boardofwatersupply.com

RICK BLANGIARDI
MAYOR
MEA

ERNEST Y. W. LAU, P.E.
MANAGER AND CHIEF ENGINEER
MANAKIA A ME KAHU WAIKI

ERWIN KAWATA
DEPUTY MANAGER
HOPE MANAKIA

NA'ALEHU ANTHONY, Chair
JONATHAN KANESHIRO, Vice Chair
BRYAN P. ANDAYA
LANCE WILHELM
KĒHAULANI PUʻU
EDWIN H. SNIFFEN, Ex-Officio
GENE C. ALBANO, P.E., Ex-Officio

December 17, 2024

Roger Babcock, Jr., PhD, P.E.
Director
Department of Environmental Services
City and County of Honolulu
roger.babcock@honolulu.gov

SENT VIA EMAIL

Dear Dr. Babcock:

Subject: Mayor's December 10, 2024 Press Conference Announcing the Selection of Area Northwest of Wahiawā as City's Proposed New Landfill Site

The Honolulu Board of Water Supply (BWS) has reviewed the City and County of Honolulu's (City) December 10, 2024 announcement of a potential landfill site located in an area northwest of Wahiawā on agricultural land to the west of Kamehameha Highway, north of Paʻalaʻa Uka Pūpūkea Road (previously referred to as "Area 3, Site 2" in the Mayor's Landfill Advisory Committee (LAC) June 2022 Final Recommendations Report, and reffered to herein as the "Proposed Landfill Site"). While BWS appreciates the difficulties associated with selecting a new landfill site, the position of the Office of the Manager and Chief Engineer (OMCE) on the Proposed Landfill Site has not changed. As you know, by letter dated November 16, 2022, I exercised my authority as Manager and Chief Engineer to formally disapprove the six landfill locations identified by the Department of Environmental Services (ENV), including the Proposed Landfill Site (Babcock, 2022), because operation of a new landfill at any of these locations may impact the quality and/or quanity of the water resources used or expected to be used as drinking water (Lau, 2022). Neither the City nor ENV sought reconsideration of that final decision.

Board of Water Supply's Legal Authority Concerning Plans Proposing Waste Disposal Facilities

BWS is authorized to establish "No Pass Zones," which generally prohibit the installation of waste disposal facilities in sensitive areas in order to protect O'ahu's critical underground drinking water resources from contamination. See BWS Rules and Regulations §3-301(2). BWS' Rules and Regulations further empower the Manager and Chief Engineer to disapprove proposed waste disposal facilities, including landfills, that may affect the quality and/or quanity of water resources used or expected to be

r Babcock, Jr.
er 17, 2024

domestic water. See BWS Rules and Regulations §3-301(3). All six of the
landfill sites in the June 2022 Final Recommendations Report of the LAC are
bove the BWS' No Pass Zone and over O'ahu's hydrogeologically-connected
water aquifer system. Accordingly, all six proposed landfill sites—including the
Landfill Site—were disapproved in my November 2022 letter.

s the importance of this groundwater aquifer been more apparent, and never
esponsibilty to protect it been more paramount. As you know, the people of
still coping with what the Hawai'i State Department of Health aptly described
hanitarian and environmental disaster," caused by fuel releases from the
ed Hill Bulk Fuel Storage Facility (Red Hill), that resulted in the contamination
s drinking water supply and the pollution of this island's irreplaceable sole-
oundwater aquifer. This unfortunate environmental catastrophe is a stark
that we all need to be proactive in protecting all of our precious drinking water
s from underground sources of contamination. O'ahu's aquifer cannot be

plained in prior correspondence and presentations to the LAC, BWS
nds the need for a new landfill, as well as the challenges associated with
new landfill site. We also recognize that modern landfill design and
ng can attempt to reduce the risk that contaminant constituents will adversely
e environment. However, the Proposed Landfill Site is located above the
d No Pass Zone and sits directly over O'ahu's drinking water aquifer system.
Geological Survey (USGS), citing EPA studies, has concluded that all landfills
will leak into the environment and that the fate and transport of leachate in
nment, from both old and modern landfills, are a potentially serious
ental problem (USGS, 2003).

data demonstrates that landfill leachates can and do contain a wide range of
organic and organic chemical constituents in varying concentrations—such as
tals, chlorides, volatile and semi-volatile organic, and per- and polyfluorinated
es (PFAS)—that, if released into the environment, have the potential to
affect drinking water resources. For example, the Waimānalo Gulch Sanitary
enerates approximately 3.6 million gallons of leachate annually that contains
concentrations of heavy metals, chlorides, sodium, total dissolved solids
henols, and amines well above their respective EPA drinking water maximum
ant levels (MCLs). Heavy rainfall can exacerbate landfill leachate containment
Indeed, intense storms that occured on O'ahu in December 2010 and
011 resulted in the generation of additional leachate at the Waimānalo Gulch
nd ultimately gave rise to illegal discharges of municipal debris, medical waste,
ate to the nearby Waimānalo Gulch stream and ultimately the Pacific Ocean.
chate from the Propsed Landfill Site would constitute a significant source of
contamination that could impact O'ahu's groundwater aquifer system.

hu's groundwater is hydrogeologically-connected and groundwater is always
ontamination in one part of the aquifer can spread to and impact other parts of
r. Further, groundwater flow can be unpredictable and can move relatively

Dr. Roger Babcock, Jr.
December 17, 2024
Page 3

quickly (greater than ten feet per day in some instances). Because of this, contaminant migration along preferential flow paths will likely elude even a robust monitoring well network and undetected contaminants could make their way to drinking water production wells before any corrective action can occur. As a result, contamination from landfill leachate poses a considerable risk to both O'ahu's groundwater aquifer and drinking water resources. If such contamination were to occur, it could—as was the case for Red Hill—eventually cause BWS to shut down its water supply wells in the vicinity of the source of contamination at the landfill.

In sum, the No Pass Zone was established to protect O'ahu's drinking water from underground sources of contamination and there is a compelling basis upon which to expect that a landfill situation at the Proposed Landfill Site may impact the quality and/or quantity of the water resources used or expected to be used as drinking water. Accordingly, for the reasons provided in my November 16, 2022 letter (Lau, 2022) and reiterated above, I reaffirm my prior disapproval of the Proposed Landfill Site.

BWS is committed to safeguarding Hawai'i's critical drinking water resources for present and future generations and continues to urge ENV to explore new landfill sites that are below the No Pass Zone. If you have any questions, please feel free to contact me at (808) 748-5061.

Very truly yours,

Ernest Y.W. Lau, P.E.
Manager and Chief Engineer

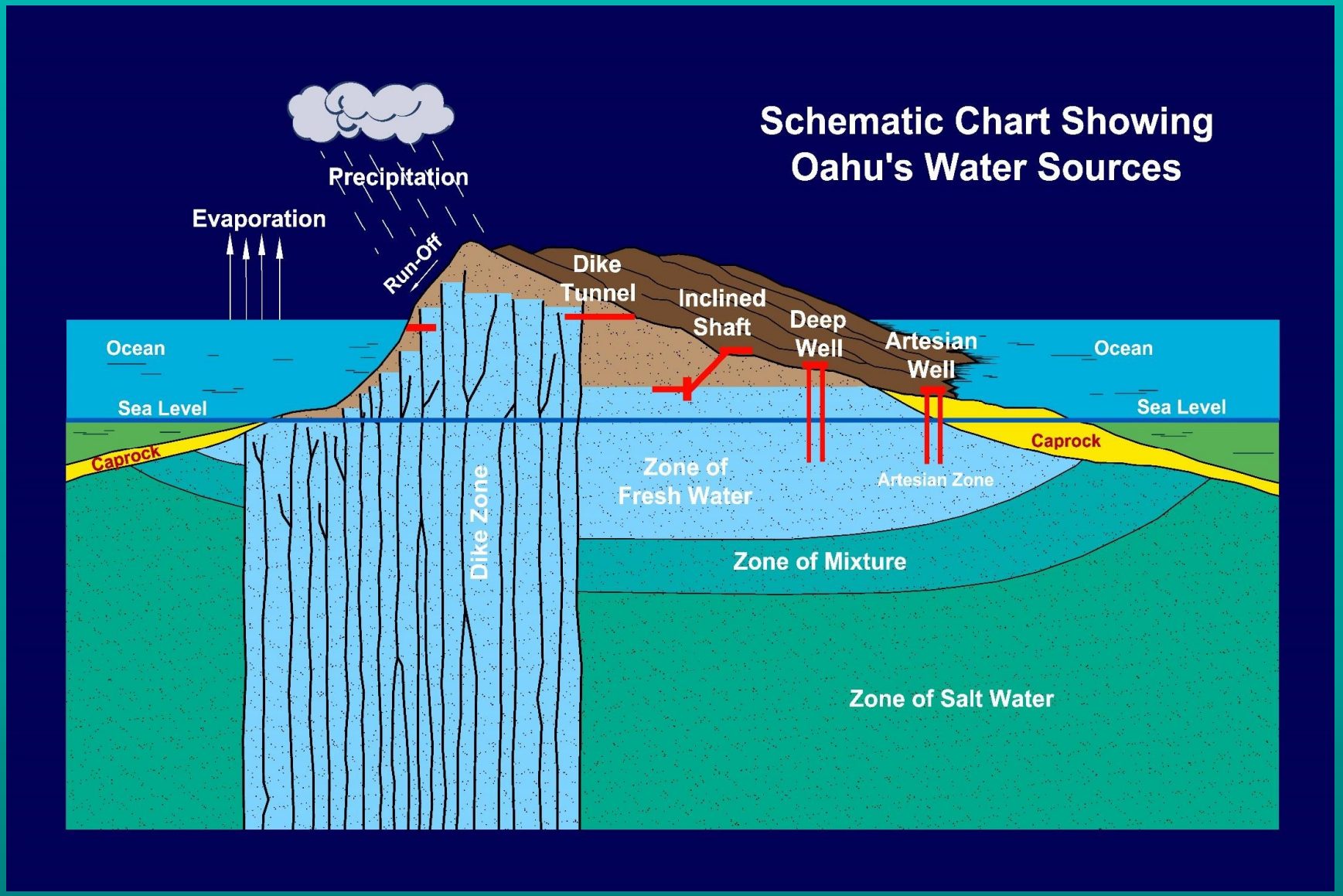
Attachments:

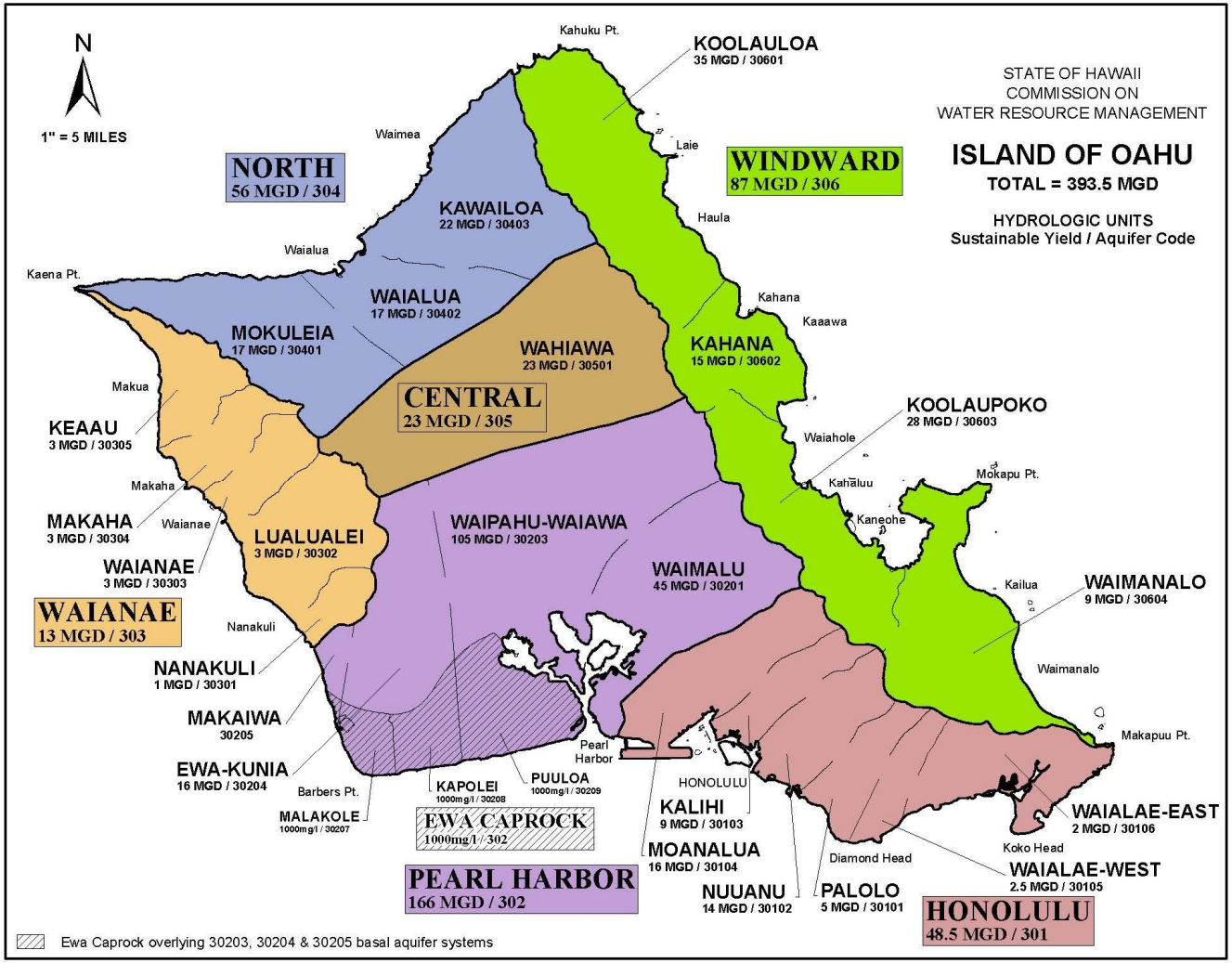
1. Lau. 2022. Response to November 3, 2022 letter regarding BWS' official position on the six potential landfill sites, November 16, 2022.
2. Babcock. 2022. Request for clarity on BWS' legal authority over landfill siting and whether that authority was exercised and if not exercised, when the City should seek a determination, November 3, 2022.
3. Christenson, Scott C. and Cozzarelli, Isabelle M. Cozzarelli. The Norman Landfill Environmental Research Site: What Happens to the Waste in Landfills? USGS Fact Sheet 040-03, August 2003

cc: The Honorable Rick Blangiardi, Mayor, City and County of Honolulu
Michael D. Formby, Managing Director, City and County of Honolulu
Michael O'Keefe, Deputy Director, Department of Environmental Services
Na'ālehu Anthony, BWS Board Chair

KEY POINTS OF CONCERN

- Oahu is 100% dependent on its groundwater aquifer for drinking water.
- Landfills contain contaminants that can enter groundwater.
- Landfills, once constructed will be there permanently.
- Preservation and protection of our precious and pure groundwater resources are essential to ensure water security for our future for generations to come.


Schematic Chart Showing
Oahu's Water Sources
Precipitation
Evaporation
Run-Off
Dike
Tunnel
Inclined
Shaft
Deep
Well
Artesian
Well
Ocean
Ocean
Sea Level
Sea Level
Caprock
Caprock
Zone of
Fresh Water
Artesian Zone
Dike Zone
Zone of Mixture
Zone of Salt Water


N
1" = 5 MILES
STATE OF HAWAII
COMMISSION ON
WATER RESOURCE MANAGEMENT
ISLAND OF OAHU
TOTAL = 393.5 MGD
HYDROLOGIC UNITS
Sustainable Yield / Aquifer Code
NORTH
56 MGD / 304
WINDWARD
87 MGD / 306
CENTRAL
23 MGD / 305
PEARL HARBOR
166 MGD / 302
HONOLULU
48.5 MGD / 301
EWA CAPROCK
1000mg/l / 302
KOOLAULOA
35 MGD / 30601
KAWAILOA
22 MGD / 30403
WAIALUA
17 MGD / 30402
MOKULEIA
17 MGD / 30401
WAHIAWA
23 MGD / 30501
KAHANA
15 MGD / 30602
KOOLAUPOKO
28 MGD / 30603
KEAAU
3 MGD / 30305
MAKAHA
3 MGD / 30304
WAIANAE
3 MGD / 30303
WAIANAE
13 MGD / 303
LUALUALEI
3 MGD / 30302
WAIPAHU-WAIAWA
105 MGD / 30203
WAIMALU
45 MGD / 30201
WAIMANALO
9 MGD / 30604
NANAKULI
1 MGD / 30301
MAKAIWA
30205
EWA-KUNIA
16 MGD / 30204
MALAKOLE
1000mg/l / 30207
KAPOLEI
1000mg/l / 30208
PUULOA
1000mg/l / 30209
KALIHI
9 MGD / 30103
MOANALUA
16 MGD / 30104
NUUANU
14 MGD / 30102
PALOLO
5 MGD / 30101
WAIALAE-EAST
2 MGD / 30106
WAIALAE-WEST
2.5 MGD / 30105
Kahuku Pt.
Waimea
Laie
Haula
Waialua
Kaena Pt.
Kahana
Kaaawa
Makua
Waiahole
Kahāluu
Mokapu Pt.
Kaneohe
Makaha
Waianae
Kailua
Nanakuli
Waimanalo
Pearl Harbor
Makapuu Pt.
HONOLULU
Barbers Pt.
Koko Head
Diamond Head
Ewa Caprock overlying 30203, 30204 & 30205 basal aquifer systems
06/20/2018
Map Projection: Universal Transverse Mercator

LANDFILLS

- EPA has concluded that all landfills eventually leak into the environment (Fed. Reg. v. 53, no. 168, August 30, 1988)
- Christenson and Cozzarelli, US Geological Survey, August 2003
  - Although liners and leachate collection systems minimize leakage, liners can fail and leachate collections systems may not collect all the leachate that escapes from a landfill.
  - The fate and transport of leachate in the environment, from both old and new landfills, is a potentially serious environmental problem.
- Landfill liners and cover systems are designed to contain leachate and control emissions, but even the best-designed systems will fail at some point unless they are replaced or the waste is removed (EPA's 2020 Interim Guidance, December 18, 2020).
- Waimanalo Gulch Landfill generates about 3.6 MG leachate annually (9,800 GPD) * Landfills in higher rainfall areas can yield higher leachate volumes.

LANDFILL LEACHATE AND GROUNDWATER ANALYSIS

Analyte	Waimanalo Gulch Leachate Ash SMP*	Waimanalo Gulch GW MW-14*	BWS Honouliuli Wells I	BWS Beretania Low Service
pH	6.52	6.64	7.12	8.20
Aluminum	9,600 ppb	No data	ND	ND
Arsenic	9.0 ppb	No data	ND	ND
Barium	710 ppb	No data	ND	2 ppb
Calcium	3,000 ppm	87 ppm	28 ppm	12 ppm
Cadmium	1,300 ppb	No data	ND	ND
Chromium	320 ppb	No data	1.3 ppb	1.7 ppb
Chloride	22,000 ppm	920 ppm	156 ppm	73 ppm

*Ref. Waimanalo Gulch Sanitary Landfill First Semi-Annual 2021 Groundwater and Leachate Monitoring Report, August 23, 2021

No data = no test results; ND = tested and not detected

LANDFILL LEACHATE AND GROUNDWATER ANALYSIS – CONT.

Analyte	Waimanalo Gulch Leachate Ash SMP*	Waimanalo Gulch GW MW-14*	BWS Honouliuli Wells I	BWS Beretania Low Service
Copper	880 ppb	No data	13 ppb	2.8 ppb
Iron	180,000 ppb	No data	2 ppb	2 ppb
Lead	14 ppb	No data	ND	ND
Mercury	2 ppb	No data	ND	ND
Nickel	4,400 ppb	No data	ND	ND
Potassium	2,000 ppm	17 ppm	4.6 ppm	3.6 ppm
Sodium	8,400 ppm	380 ppm	63 ppm	35 ppm
Total dissolved solids	45,000 ppm	1,900 ppm	573 ppm	267 ppm

*Ref. Waimanalo Gulch Sanitary Landfill First Semi-Annual 2021 Groundwater and Leachate Monitoring Report, August 23, 2021

No data = no test results; ND = tested and not detected

LANDFILL LEACHATE AND GROUNDWATER ANALYSIS – CONT.

Analyte	Waimanalo Gulch Leachate Ash SMP*	Waimanalo Gulch GW MW-14*	BWS Honouliuli Wells I	BWS Beretania Low Service
Vanadium	160 ppb	No data	26 ppb	21 ppb
Zinc	1,900 ppb	No data	ND	ND
2-butanone (MEK)	120 ppb	No data	ND	ND
Dinoseb	2.0 ppb	No data	ND	ND
Toluene	No data	0.19 ppb	ND	ND
3-methyl phenol	770 ppb	No data	No data	No data
4-methyl phenol	770 ppb	No data	No data	No data
N-nitroso-di-n-propylamine	12 ppb	No data	No data	No data

*Ref. Waimanalo Gulch Sanitary Landfill First Semi-Annual 2021 Groundwater and Leachate Monitoring Report, August 23, 2021

No data = no test results; ND = tested and not detected

LANDFILL LEACHATE AND GROUNDWATER ANALYSIS – CONT.

Analyte	Waimanalo Gulch Leachate Ash SMP*	Waimanalo Gulch GW MW-14*	BWS Honouliuli Wells I	BWS Beretania Low Service
N-Nitrosomethylethylamine	68 ppb	No data	No data	No data
Phenol	290 ppb	No data	No data	No data

*Ref. Waimanalo Gulch Sanitary Landfill First Semi-Annual 2021 Groundwater and Leachate Monitoring Report, August 23, 2021

No data = no test results; ND = tested and not detected

Average PFAS Concentrations in Different Types of Landfill Leachate Reported in Published Studies

Landfill type	Country	Mean PFAS Range (ng/L)	References
MSW landfill	USA	BDL* – 17,710	Solo-Gabriele et al., 2020; Lang et al., 2017; Huset et al., 2011
MSW landfill	Germany	BDL* – 2,968	Busch et al., 2010
MSW landfill	Spain	BDL* – 840.5	Fuertes et al., 2017
MSW landfill	Canada	BDL* – 8,700	Benskin et al., 2012
MSW landfill	Australia	BDL* – 1,700	Gallen et al., 2017
MSW landfill	China	BDL* – 41,600	Yan et al., 2015

Landfill type	Country	Mean PFAS Range (ng/L)	References
Ash monofill	USA	BDL* – 742	Solo-Gabriele et al., 2020
C&D debris landfill	USA	BDL*– 4,630	Solo-Gabriele et al., 2020

*BDL = below detection limit; ng/L = nanograms per liter

Source: EPA's 2020 Interim Guidance on the Destruction and Disposal of Perfluoroalkyl and Polyfluoroalkyl Substances and Materials Containing Perfluoroalkyl and Polyfluoroalkyl Substances (Interim Guidance for Public Comment December 18, 2020)

TABLE 2.2: SUMMARY OF LITERATURE STUDY - PFOA & PFOS CONCENTRATIONS IN LANDFILL LEACHATE

Source Cited	Location/ Region	Sample Size	PFOA EPA Drinking Water MCL = 4ng/L			PFOS EPA Drinking Water MCL = 4 ng/L		
			Detection Frequency%	Concentration Range (ng/l)	Median (ng/l)	Detection Frequency %	Concentration Range (ng/l)	Median (ng/l)
1. Huset, et al (2011)	USA	5	100	380 - 1,000	490	100	56 -160	97
2. Allred, et al (2015)	USA	6	100	150 - 5,000	1,055	100	25 - 590	155
3. Lang, et al (2017)	USA	87	100	30 - 5,000	590	96	3-800	99
4. Benskin, et al (2012)	Canada	5	100	210 - 1,500	520	100	80 - 4,400	390
5. Kallenborn, et al (2004)	Nordic Countries	NA	NA	90-501	230	NA	30 - 190	80
6. Bossi, et al (2008)	Denmark	NA	NA	0 - 6	3	NA	0 - 4	NA
7. Woldegiorgis, et al (2008)	Sweden	NA	NA	40 - 1,000	540	NA	30 - 1,500	550
8. Busch, et al (2010)	Germany	20	95	0 - 926	57	100	0 - 235	3
9. Fuertes, et al (2017)	Spain	6	100	200 - 585	437	17	0 - 44	NA
10. Gullen, et al (2016)	Australia	17	100	19 - 2,100	450	89	0 - 100	31
11. Gullen, et al (2017)	Australia	97	64	17 - 7,500	600	65	13 - 2,700	220
12. Yan, et al (2015)	China	6	100	281 - 214,000	2,260	100	1,150 - 6,020	1,740

Source: Michigan Waste & Recycling Association Statewide Study on Landfill Leachate PFOA and PFOS Impact on Water Resource Recovery Facility Influent, Technical Report Completed in Collaboration with Michigan Department of Environmental Quality, March 1, 2019 (Second Revision March 6, 2019)

PFAS IN WAIMANALO GULCH LANDFILL

Appendix 7: Landfill Leachate Data

Field Study of PFASs in Hawai´i

LF #1 (Waimanalo Gulch Landfill)

Sample: WGLF E-6

Compound	Pre-TOPs Leachate (ng/L)	% Makeup
5:3 FTCA⁻	26,000	40%
PFBS⁻	14,000	22%
PFHxA⁻	9,600	15%
PFPeA⁻	4,400	7%
PFOA⁻	3,200	5%
Other	7,464	12%
Total:	64,664	100%
PFBA⁻	2,800	
PFHpA⁻	1,300	
7:3 FTCA⁻	980	
3:3 FTCA⁻	820	
PFHxS⁻	620	
6:2 FTS⁻	420	
PFPeS⁻	190	
PFOS⁻	150	
PFNA⁻	110	
PFMPA⁻	45	
PFDA⁻	29	

Sample: WGLF 4-B

Compound	Pre-TOPs Leachate (ng/L)	% Makeup
5:3 FTCA⁻	8,500	21%
PFHxA⁻	6,200	15%
PFBA⁻	5,800	14%
PFPeA⁻	4,400	11%
PFBS⁻	3,200	8%
Other	12,518	31%
Total:	40,618	100%
PFOA⁻	2,900	
PFHxS⁻	2,900	
PFOS⁻	1,800	
7:3 FTCA⁻	1,700	
PFHpA⁻	1,500	
6:2 FTS⁻	640	
PFPeS⁻	440	
3:3 FTCA⁻	330	
PFNA⁻	140	
8:2 FTS⁻	79	
PFDA⁻	46	
PFHpS⁻	43	

Sample: WGLF-ASH

Compound	Pre-TOPs Leachate (ng/L)	% Makeup
PFHxA⁻	4,700	36%
PFPeA⁻	3,100	24%
PFBA⁻	1,400	11%
5:3 FTCA⁻	1,300	10%
PFBS⁻	870	6.7%
Other	1,600	12%
Total:	12,970	100%
PFHpA⁻	730	
PFOA⁻	540	
3:3 FTCA⁻	180	
7:3 FTCA⁻	150	

BWS NO-PASS ZONE

November 28, 2020

www.boardofwatersupply.com

OAHU'S GROUNDWATER BODIES AND CAPROCK

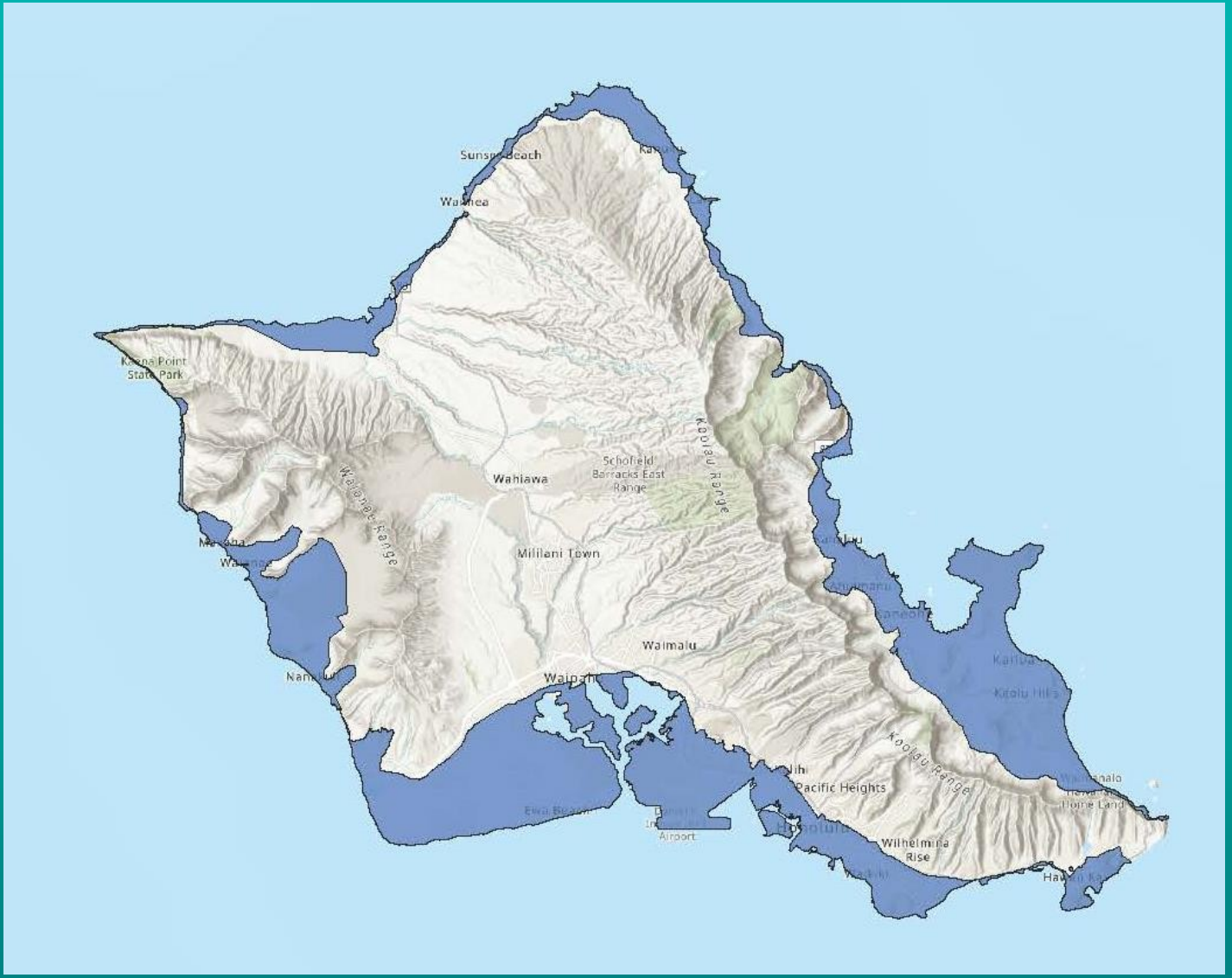
- Oahu is 598 square miles
- About 461 square miles of Oahu (77% of the island) are inland of the caprock
- About 137 square miles (23% of the island) are covered by caprock

Ref. Izuka, Engott, Rotzoll, Bassiouni, Johnson, Miller and Mair, Volcanic aquifers of Hawai'i—Hydrogeology, water budgets, and conceptual models, Scientific Investigations Report 2015-5164, United States Geological Survey, 2015

BWS “No Pass Zone”

Established December 9, 1982 (Resolution 502, 1982).

Amended BWS Rules and Regulations Section 3-301 to add definition and establishment of “No Pass Zone” and outlining an appeals procedure from decisions of the Manager relative to the "No Pass Zone“




Proposed Landfill Site
Kahuku
Laie
KOOLAULOA
Kawailoa Beach
KAWAILOA
WAIALUA
MOKULEIA
KEAAU
KAHANA
WAHIAWA
Schofield Barracks E Quad
Wahiawa
Waiahole-Waikane
MAKAHA
Makaha Valley
WAIANAE
Honolulu
Waianae
Mililani Town
WAIPAHU-WAIAWA
Ahuimanu
KOOLAUPOKO
LUALUALEI
Kaneohe
Waipio
WAIMALU
Kailua
Nanakuli
NANAKULI
Waimalu
Waipahu
WAIMANALO
Halawa
EWA-KUNIA
MAKAIWA
KALIHI
Kapolei
Daniel K. Inouye International Airport
NUUANU
Wa'ahila Ridge State Recreation Area
Ewa Beach
Honolulu
PALOLO
WAIALAE-EAST
Pearl Harbor National Wildlife Refuge
WAIALAE-WEST
East Honolulu

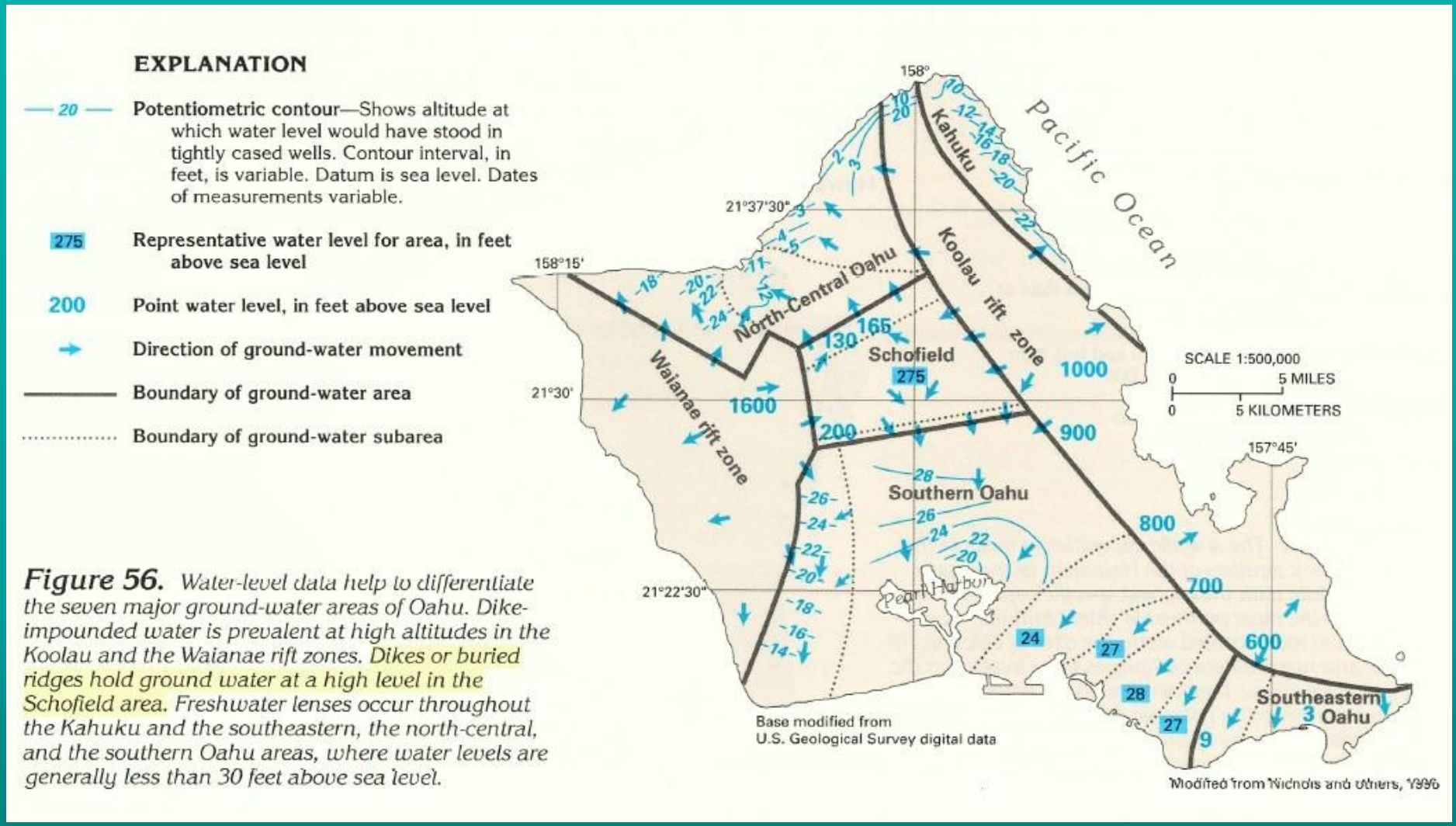


Figure 56. *Water-level data help to differentiate the seven major ground-water areas of Oahu. Dike-impounded water is prevalent at high altitudes in the Koolau and the Waianae rift zones. Dikes or buried ridges hold ground water at a high level in the Schofield area. Freshwater lenses occur throughout the Kahuku and the southeastern, the north-central, and the southern Oahu areas, where water levels are generally less than 30 feet above sea level.*

Ground Water Atlas of the United States, Segment 13, USGS, revised 1999

BWS PASS, NO-PASS ZONE GUIDELINES

- The Pass/No-Pass Zone delineation maps are used as guidelines for Groundwater Protection in implementing Section 3-301 Waste Disposal Facilities, BWS Rules and Regulations.
- The Pass zone represents areas overlain by thick “caprock” (unconsolidated and consolidated sediments, corals and weathered volcanic rock) above the permeable volcanic rock aquifers.
- The No Pass zone represents areas over the freshwater aquifer with a smaller or nonexistent caprock.
- The Pass/No-Pass zone delineation is based upon hydrogeologic literature research and data analysis by the BWS Hydrology-Geology Branch. Requests for reconsideration of No-Pass line locations should be based on technical data including boring logs which indicate that the proposed waste disposal facility in the "No Pass Zone" would not contaminate groundwater resources used or expected to be used for domestic water supplies.

CHAPTER III: PROTECTION, DEVELOPMENT AND CONSERVATION OF WATER RESOURCES
SEC. 3-301: WASTE DISPOSAL FACILITIES

1. All plans proposing the following waste disposal facilities must have the written approval of the Manager:[1]
    1. Sewage disposal systems.
        1. (1) Cesspools.
        2. (2) Septic tank systems.
        3. (3) Individual household aerobic treatment units.
    2. Disposal wells.
    3. Sanitary landfills.
    4. Refuse disposal dumps.
    5. Sewage treatment plants.
    6. Stabilization ponds.
    7. Any other wastewater disposal facilities.
2. The Department may establish "No Pass Zones" which shall be delineated on "No Pass Zone" maps. These maps shall be used as guidelines in implementing this Section.

Footnote: [1] Per March 6, 1989 BWS-DOH Agreement to Regulate the Ground Disposal of Wastes on Oahu. DOH will APPROVE/DISAPPROVE waste disposal facilities with consideration of BWS's advice. The Agreement was in response to the DOH adoption of Ch. 11-62, and Ch. 11-23, HAR.

3. The Manager may at his discretion, withhold his approval, if there is any basis to expect that the operation of the proposed waste disposal facility and any wastewater therefrom may to any degree affect the quality and/or quantity of water resources used or expected to be used for domestic water.

4. If the Manager disapproves a proposal, he shall inform the applicant in writing of the facts and reasons upon which his disapproval is based and afford the applicant an opportunity for an informal appeal hearing. Any applicant who is aggrieved by the Manager's decision and desires reconsideration of such decision shall petition the Manager in writing within 30 days from the date of receiving such decision. The applicant should base his request for reconsideration on pertinent technical data, including boring logs which indicate that the proposed waste disposal facility in the "No Pass Zone" would not contaminate groundwater resources used or expected to be used for domestic water supplies. If after the hearing, the request for reconsideration is disapproved by the Manager, the applicant may appeal the decision to the Board, which shall have the power to affirm, modify or reverse the decision of the Manager so appealed from. Such appeal shall be taken within 30 days after the final decision of the Manager.

[Eff 5/10/76; am, renum and comp BWS Res. No. 427, 1976; am and renum BWS Res. No. 502, 1982]

KEY POINTS OF CONCERN

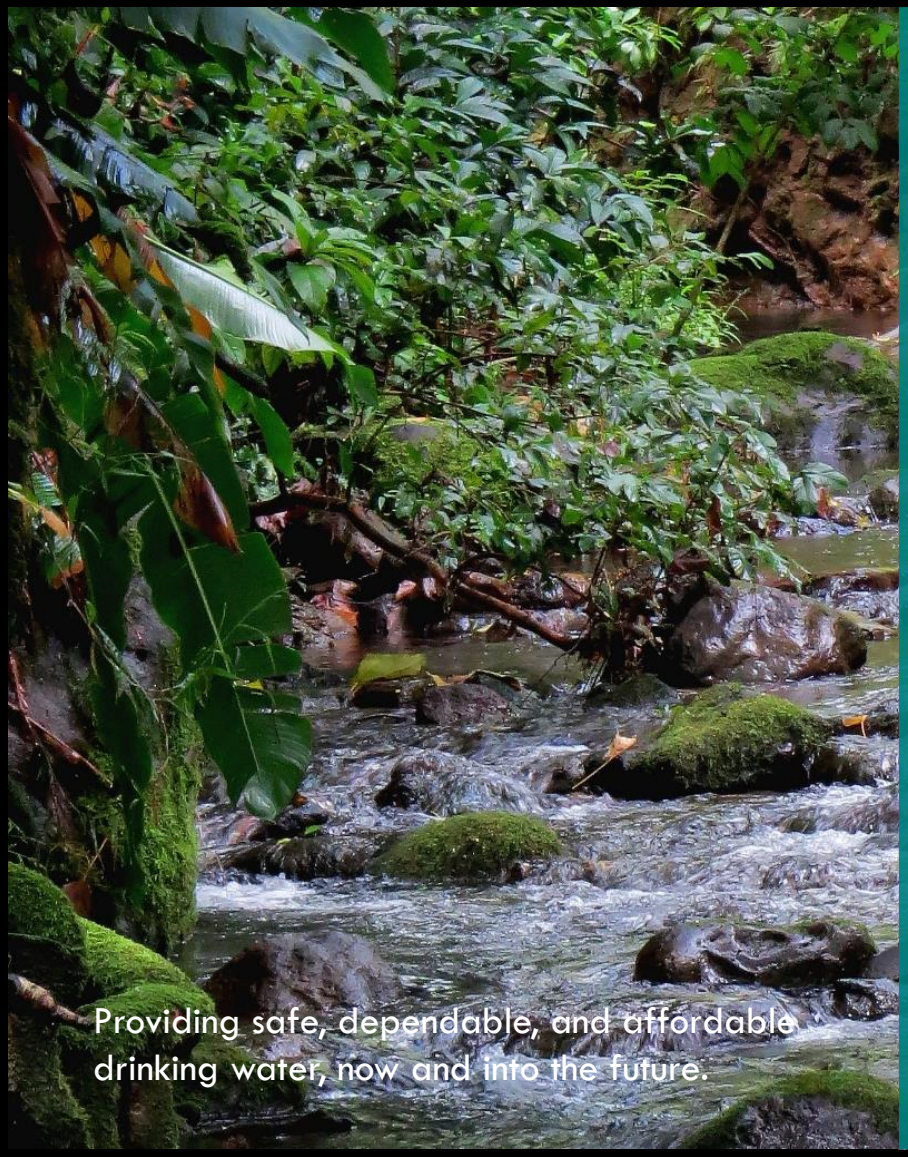
- Oahu is 100% dependent on its groundwater aquifer for drinking water.
- Landfills contain contaminants that can enter groundwater.
- Landfills, once constructed will be there permanently.
- Preservation and protection of our precious and pure groundwater resources are essential to ensure water security for our future for generations to come.

BWS Monitoring Well Installation, February 2024
Source: Honolulu Star-Advertiser

Source Water Protection Plan's Guiding Principle

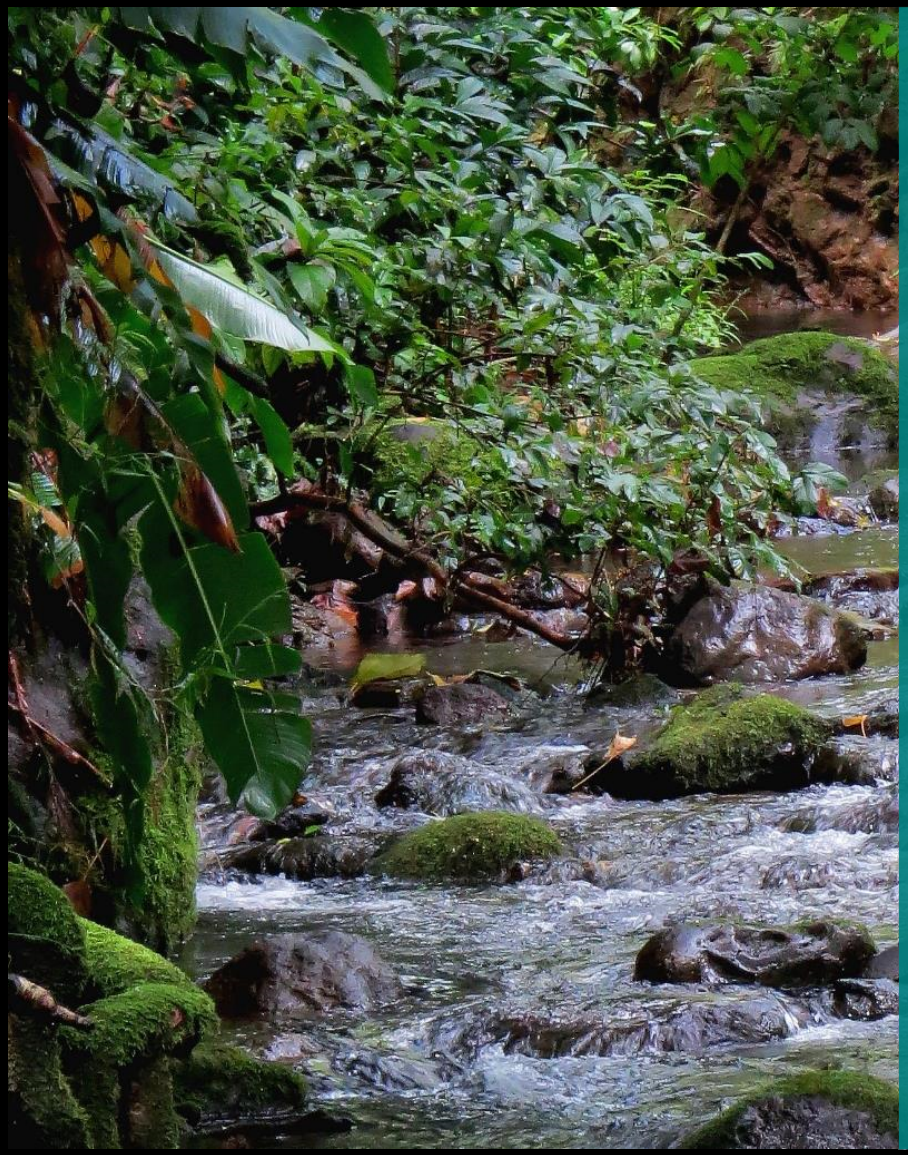
Prevention of sources from degradation is always preferable to mitigation and clean-up, thus **reducing risk** is the **foundation** of our Source Water Protection Plan

QUESTIONS AND DISCUSSION



Providing safe, dependable, and affordable drinking water, now and into the future.

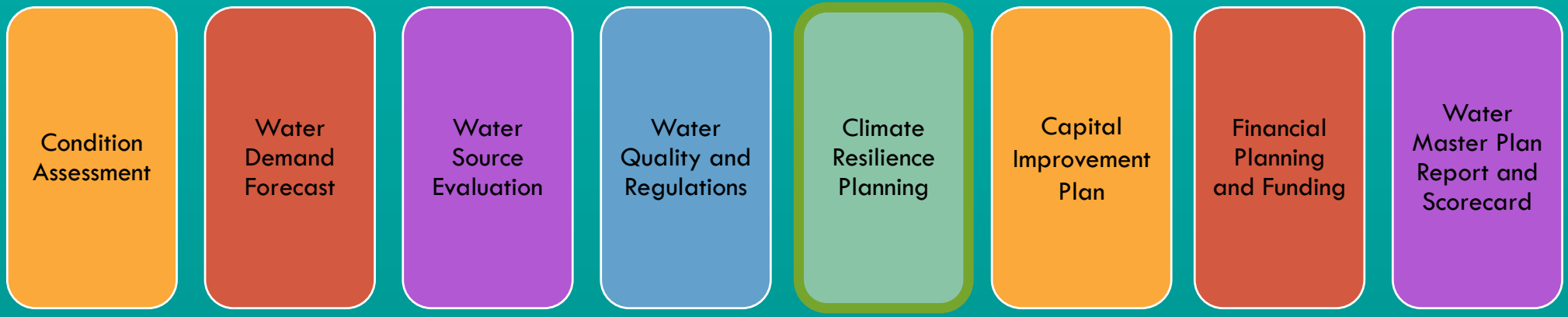
Mahalo!



CLIMATE CHANGE IMPACTS & APPROACH FOR WMP

Sebastian Malter, PE CC-P
CDM Smith
January 16, 2025

WATER MASTER PLAN
MAJOR SCOPE ELEMENTS



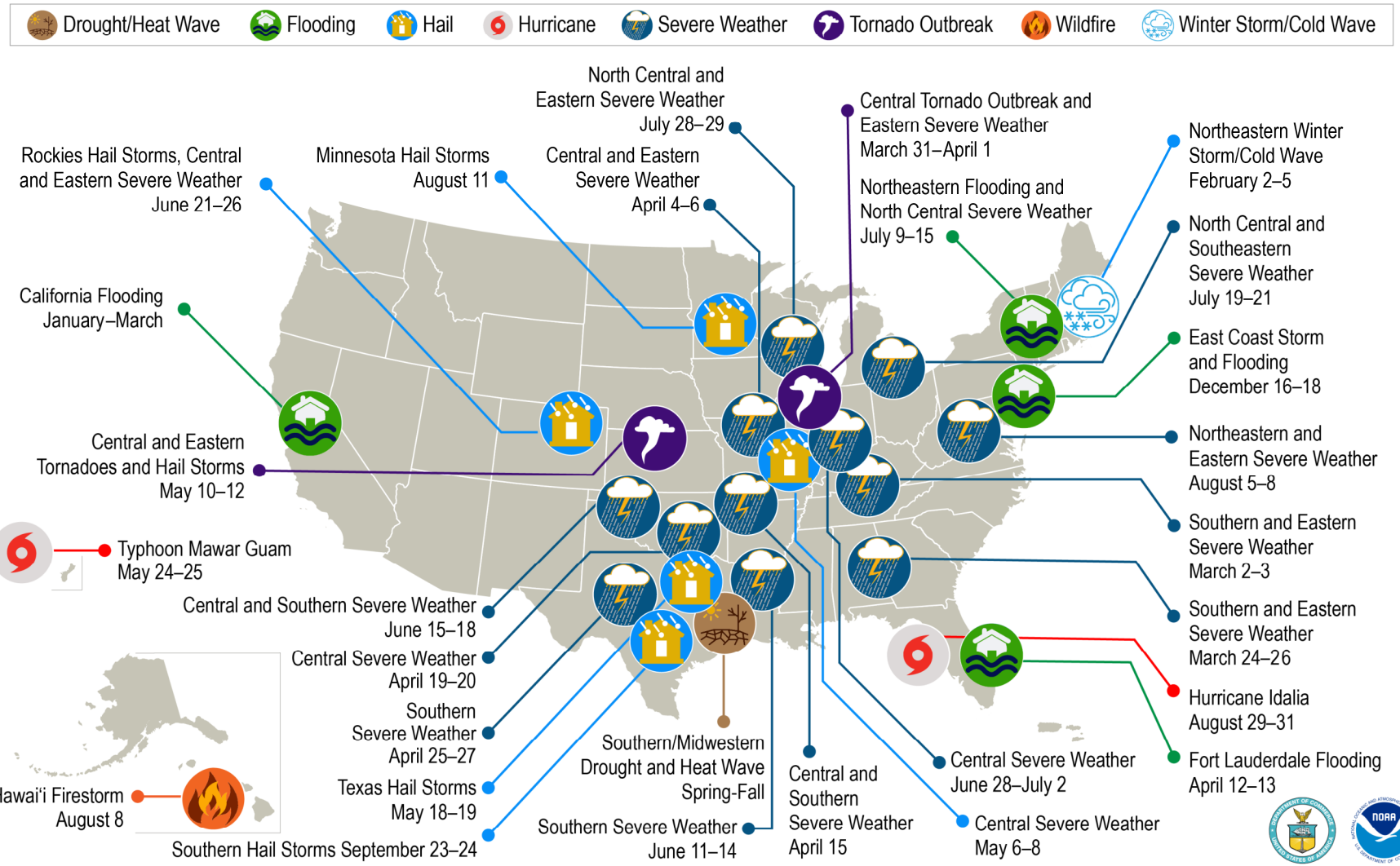
INTEGRATING THE WATER MASTER PLAN WITH OTHER CLIMATE INITIATIVES

- **State and City-wide Initiatives**
  - One Water (Water Infrastructure)
  - Community Climate Preparedness
  - Urban Climate Adaptation
  - Hazard Mitigation Planning
  - Emission reduction and decarbonization
  - Transportation
  - Solid Waste

- **Water Master Plan**
  - Water Resources
  - Water Demand
  - Critical Water Infrastructure at Highest Risk

- **American Water Infrastructure Act**
  - Natural Hazards
  - Malevolent Acts
  - Acute & Current

U.S. 2023 Billion-Dollar Weather and Climate Disasters



*This map denotes the approximate location for each of the **28 separate billion-dollar weather and climate disasters that impacted the United States in 2023.***

HAWAII CLIMATE STRESSORS

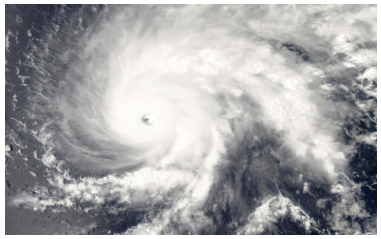
Extreme Heat

Hawaii has recorded its highest temperatures in recent years, with numerous heat records broken across the islands.

Flooding

Over 96 flash flooding events and 654 heavy rain events led to flooding between 2018 and 2022.

Total property damage of $107.3 million and crop damage of $1.8 million were reported.



Hurricanes

Category 5 Hurricane Lane, bringing torrential rains, particularly to the Big Island, where it caused major flooding and landslides.

Sea Level Rise

Waikiki Beach and North Shore of Oahu, have seen significant impacts, threatening infrastructure, homes, and iconic sandy beaches.

Droughts & Wildfires

2010 Extreme drought covered the entire state with all four counties designated as Primary Natural Disaster Areas.

When you think about climate change, what are you most concerned about?

CLIMATE IMPACTS TO SOURCE WATER (QUALITY & QUANTITY)

Climate Stressor	Climate Impact	Potential Utility Impacts
 Extreme Heat	• Increased demand • Increased evapotranspiration	• Increased demand • Modifications in treatment operations • Increased monitoring and maintenance required
 Sea Level Rise	• Saltwater intrusion	• Reduced water availability • Increased salinity in wells
 Drought	• Reduced groundwater recharge to aquifers	• Reduced water availability • Water restrictions • Community and economic impacts

CLIMATE IMPACTS TO DISTRIBUTION & TREATMENT OPERATIONS

Climate Stressor	Climate Impact	Potential Utility Impacts
 Extreme Storms	• Flooding • Storm surge • Wind damage	• Damage to equipment and infrastructure • Equipment failure • Decreased reliability of communications, water quality monitoring and energy systems • Accessibility challenges
 Extreme Heat	• Higher air temperatures • Reduced water availability	• Increased demand, but reduced supply • Equipment damage • Higher cost for cooling facilities • Blackouts due to excessive electric demand
 Sea Level Rise	• Coastal flooding	• Damage to low lying infrastructure and equipment • Corrosion of distribution system piping • Difficulty maintaining and repairing underground infrastructure • Accessibility challenges

CLIMATE IMPACTS ON UTILITY PERSONNEL

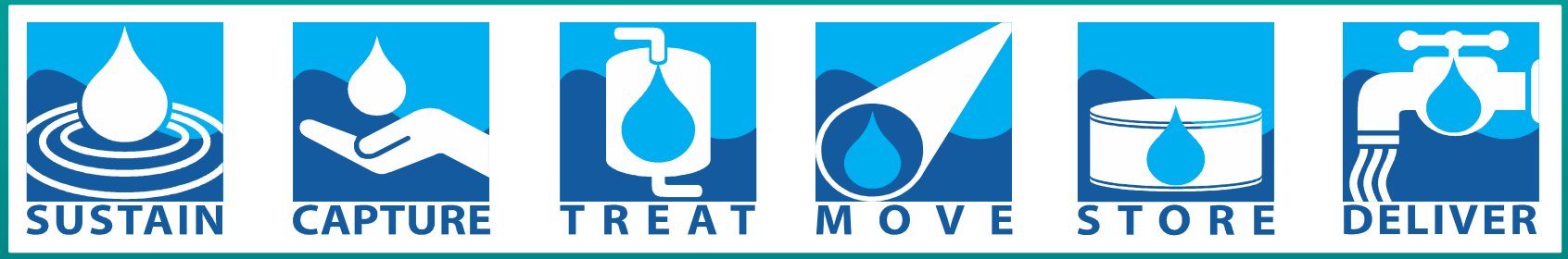
Climate Stressor	Climate Impact	Potential Utility Impacts
 Extreme Heat	• Unsafe outdoor working conditions for staff	• Heat stress impacts resulting in injuries, fatalities • Overtime hours required due to failure of systems, equipment • Increased break times for outdoor workers required
 Extreme Storms	• Flooding • Wind damage	• Increased chances of loss of life or injury • Damage to employees' vehicles, homes • Overtime hours required due to failure of systems, equipment

Comprehensive System Wide Climate Resilience Analysis

CHRONIC HAZARDS
Rising temperatures
Reduced rainfall
Sea Level Rise

ACUTE HAZARDS
Extreme rainfall and heat
Wildfires
Flooding
Droughts

Climate Change



CLIMATE RESILIENCE PLANNING

OBJECTIVES

- Determine the increased frequency and severity of natural hazards
- Identify impacts to BWS & improve resilience

IMPLEMENTATION

- Evaluate how climate stressors affect the water system
- Leverage existing studies, reports, data and information

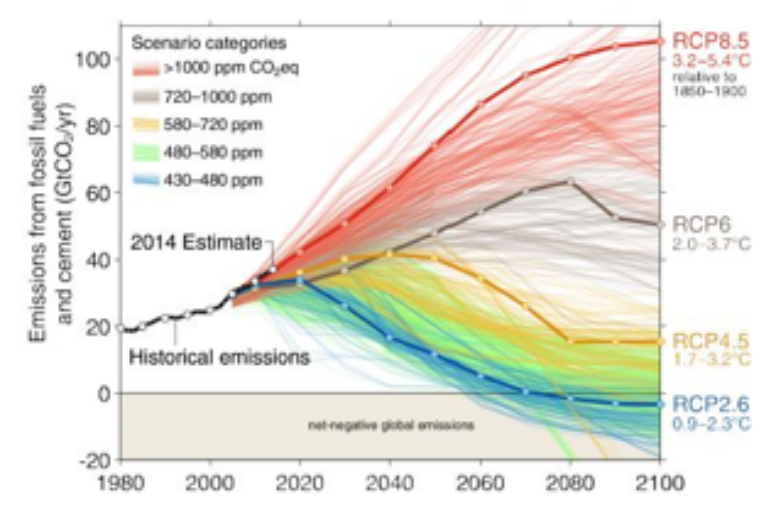
OUTCOMES

- Climate impacts and actionable data to inform WMP update
- Conceptual designs for selected resilience measures

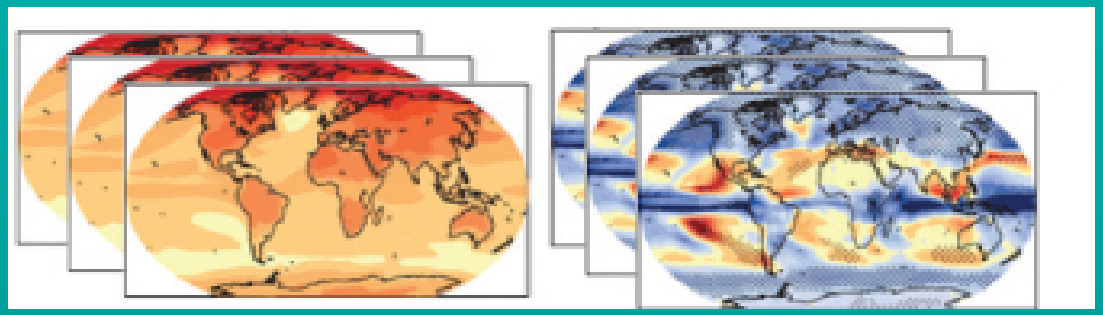
WHAT SCIENTIFIC TOOLS CAN HELP US TO ASSESS FUTURE CLIMATE?

CLIMATE MODELING AND CLIMATE PROJECTIONS

Emission Scenarios

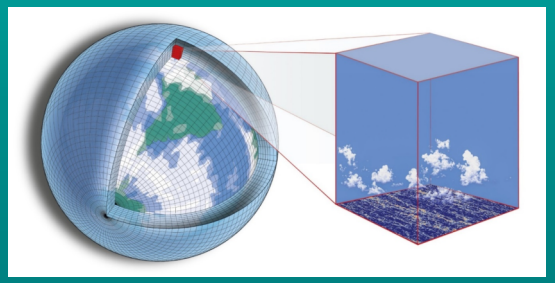


Future Climate and Sea Level Rise Projections



Emissions

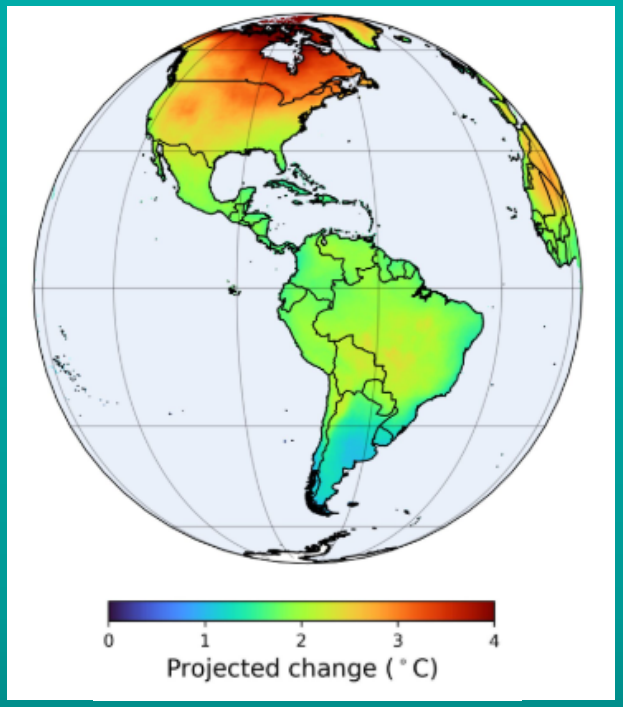
Climate Models



Climate Projections

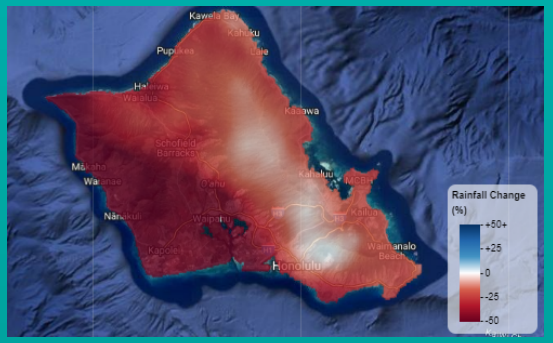
MAKING CLIMATE SCIENCE ACTIONABLE

Climate Scientists

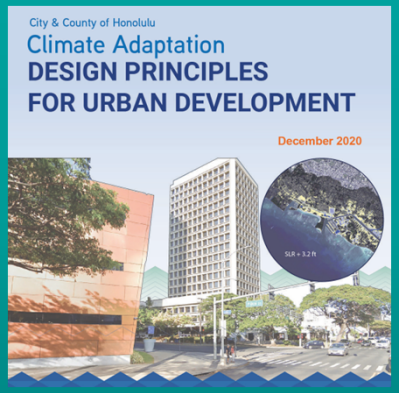


How to Use it?

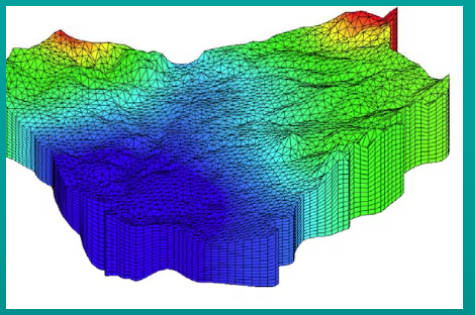
End User



Risk Assessments



Design Guidance

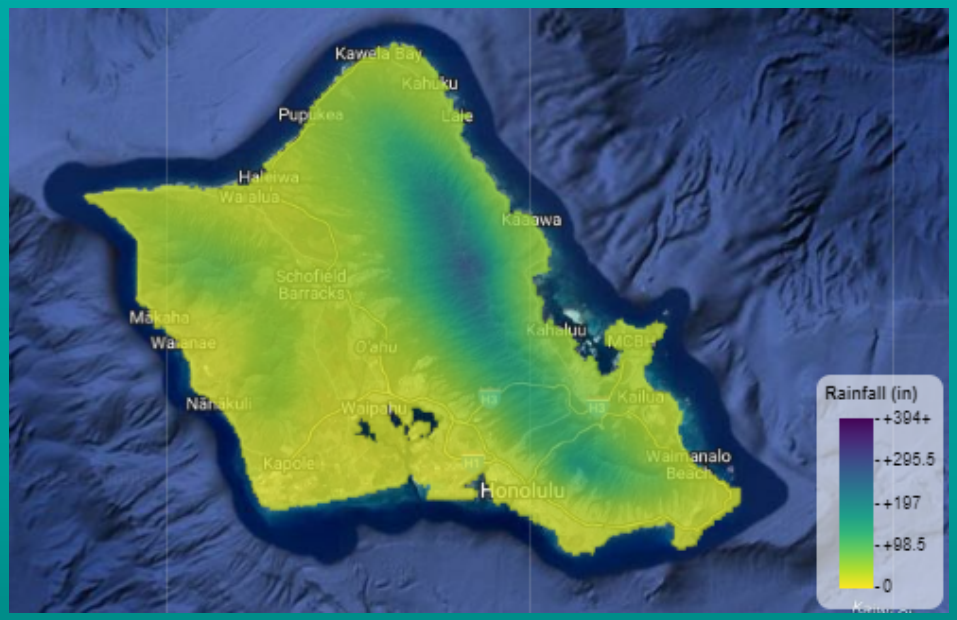


Hydrologic Modeling

WHAT DO CLIMATE MODELS TELL US ABOUT O‘AHU?

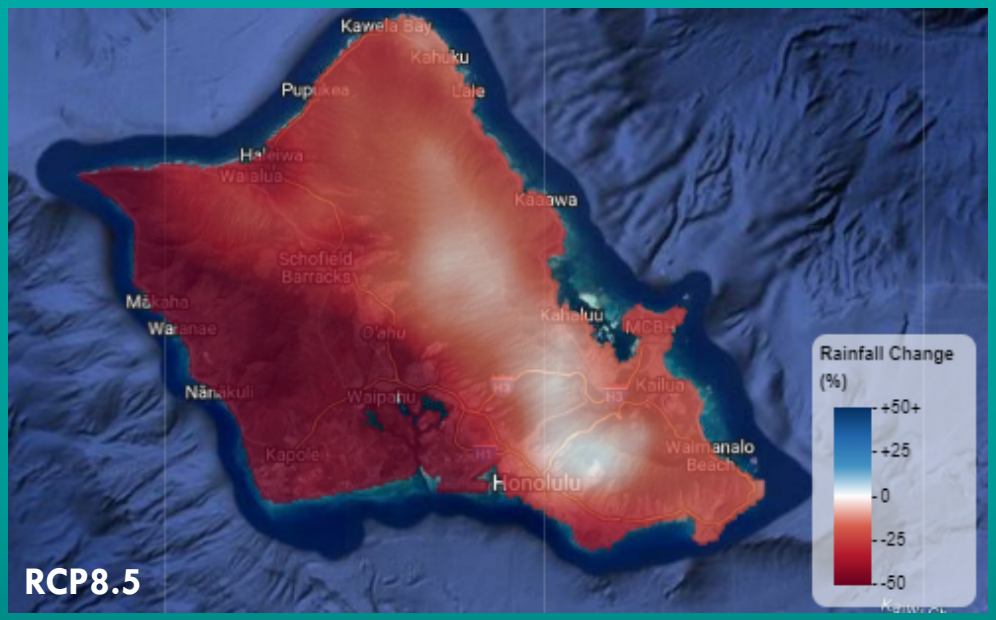
HCDP HAWAI'I CLIMATE DATA PORTAL BETA

Annual Rainfall



Present Day

Change in Annual Rainfall



High Emission Scenario (2070-2099)

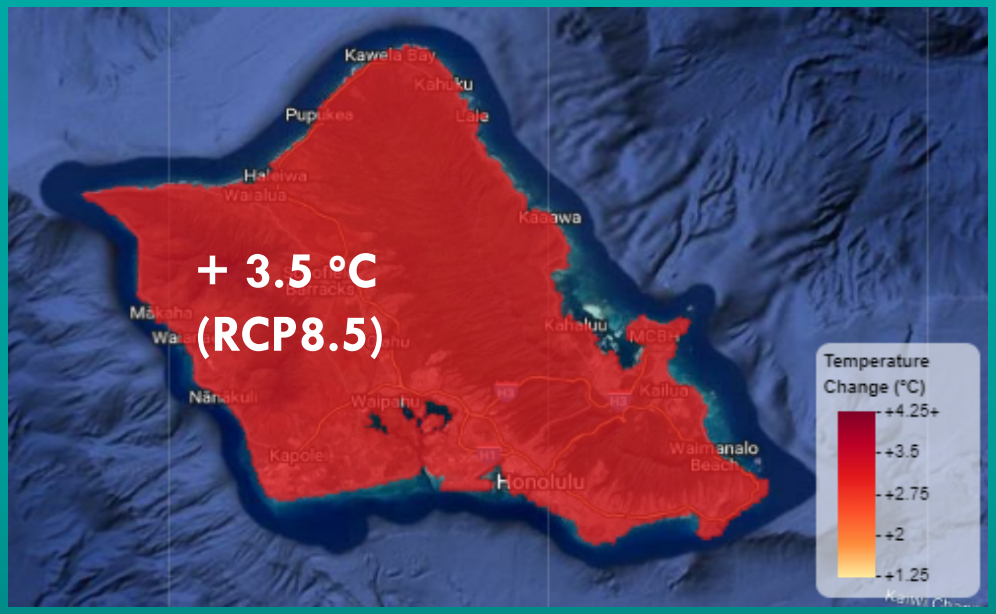
WHAT DO CLIMATE MODELS TELL US ABOUT O‘AHU?

HCDP HAWAI'I CLIMATE DATA PORTAL BETA

Average Temperature

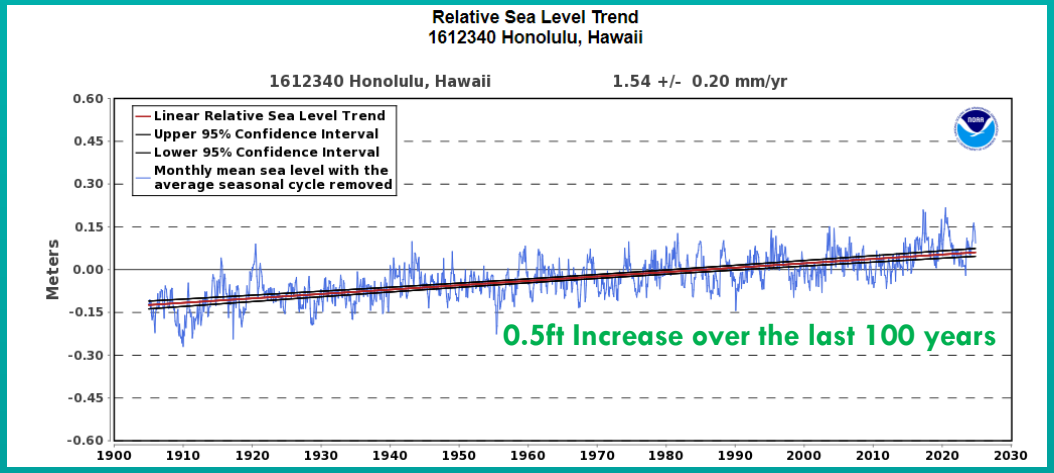
Present Day

Change in Average Temperature

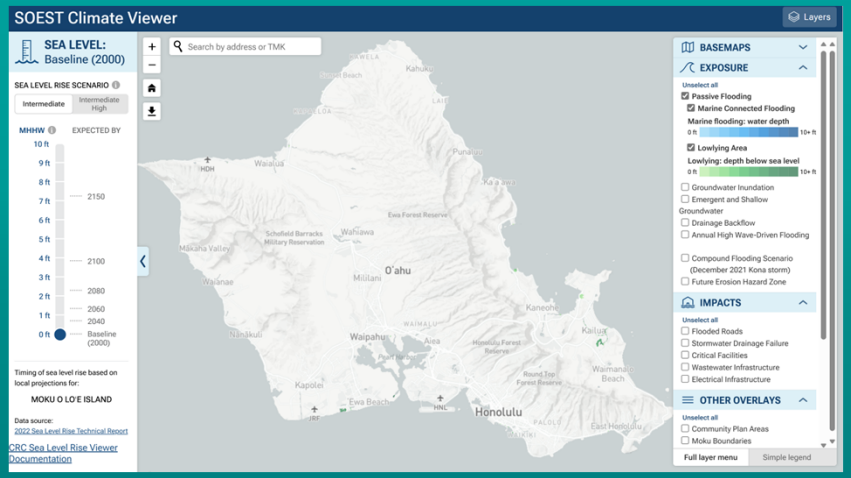


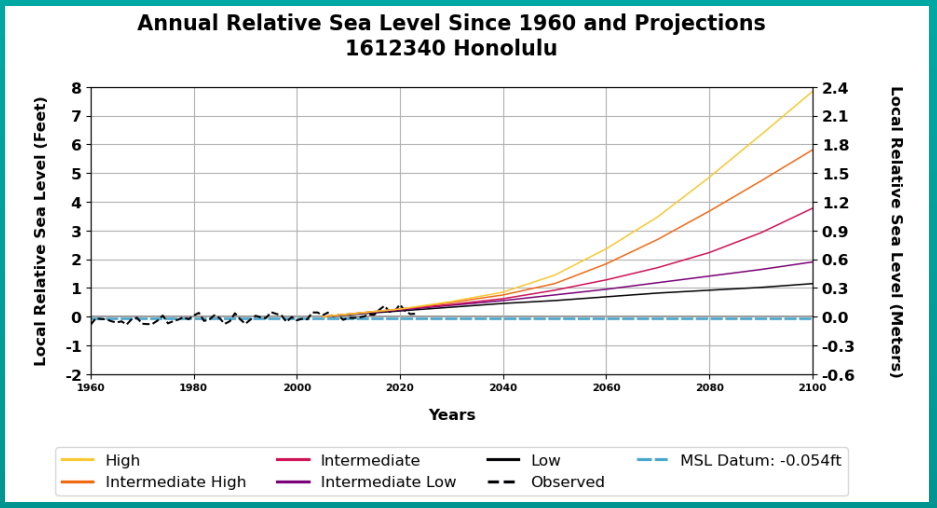
High Emission Scenario (2070-2099)

WHAT ABOUT SEA LEVEL RISE?



Sea Level Trends





2022 NOAA Sea Level Rise Scenarios

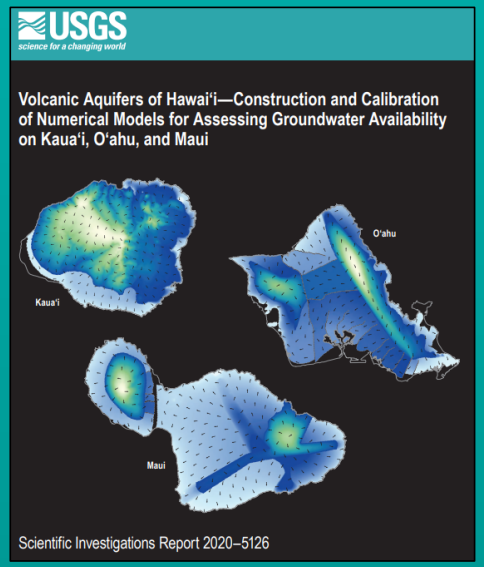
PROGRESS TO DATE

CLIMATE RESILIENCE IMPLEMENTATION

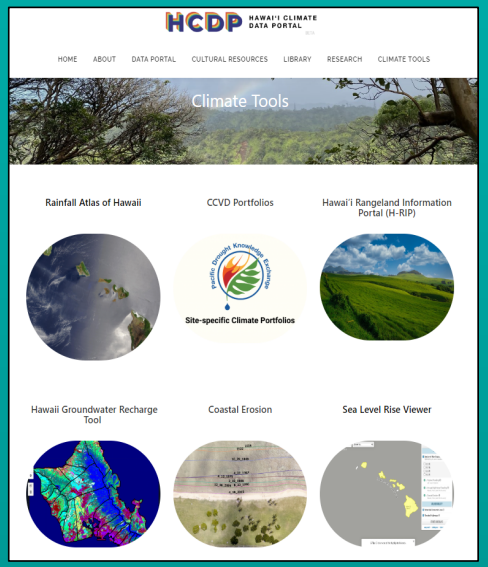
Data Collection and Review	On-going
Identifying Climate Stressors Relevant to the WMP	On-going
Technical Analyses and Assessments	On-going
Climate Impacts and Resilience Measure Development	Upcoming

DATA COLLECTION AND REVIEW

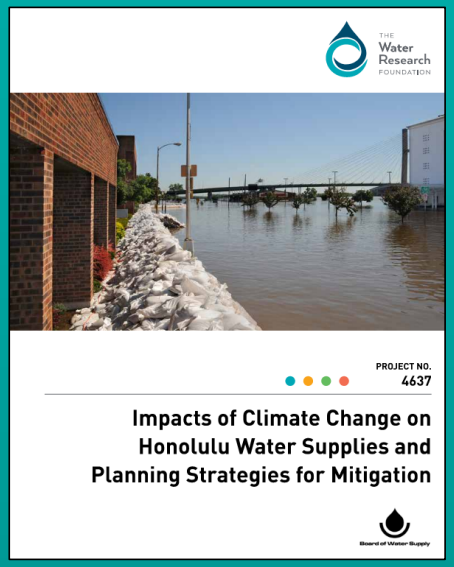
Selection of Data Sources



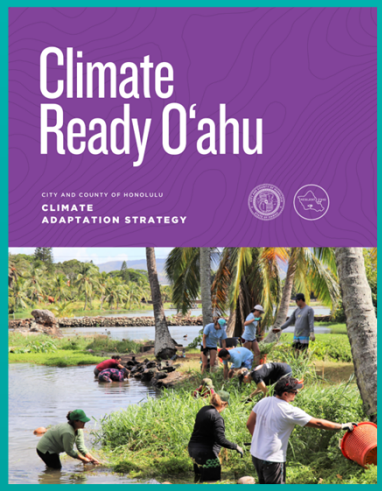
USGS



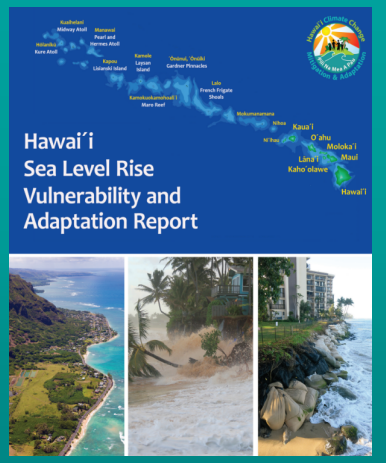
Hawaii Climate Data Center



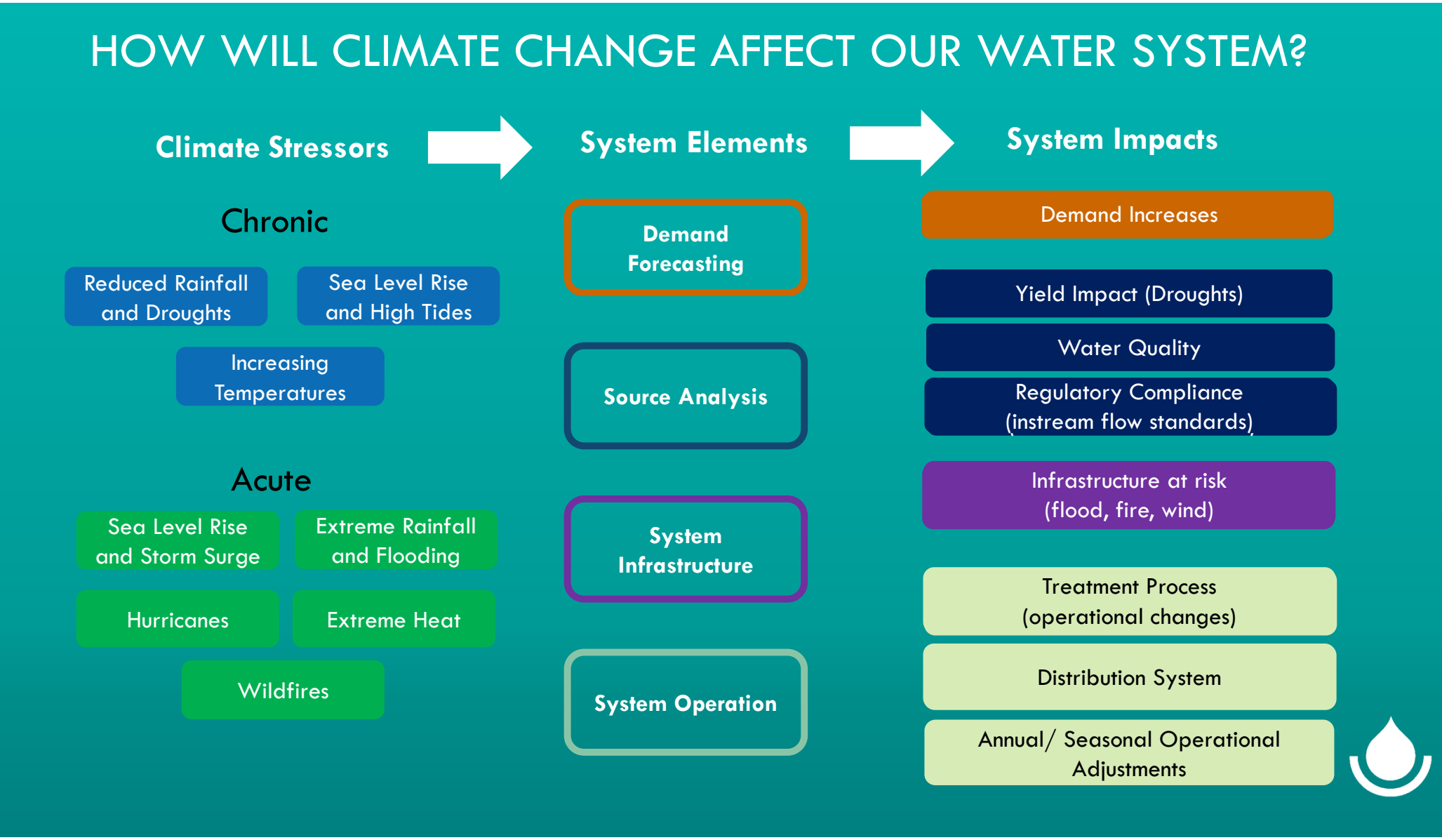
Water Research Foundation



State and Local



HOW WILL CLIMATE CHANGE AFFECT OUR WATER SYSTEM?



SOURCE ANALYSIS

- How will climate change affect our water resources?

SOURCE ANALYSIS

Current

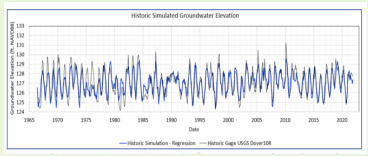
- Average Condition
- Drought Condition

Future

- Average Conditions
- Drought Conditions
- Climate-Adjusted Demand

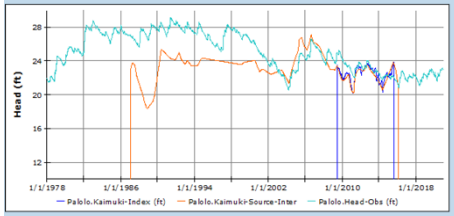
Technical Approach

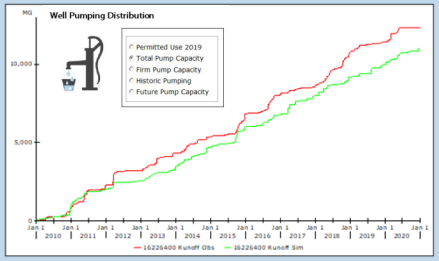
- Predictive Statistical Model



- USGS Studies

Groundwater Levels & Pumping Patterns





Management Strategies

- Water Transfers
- Demand Management
- Well Capacities

Aquifer & Supply Sustainability

WMP

Linking Climate Data to Impacts

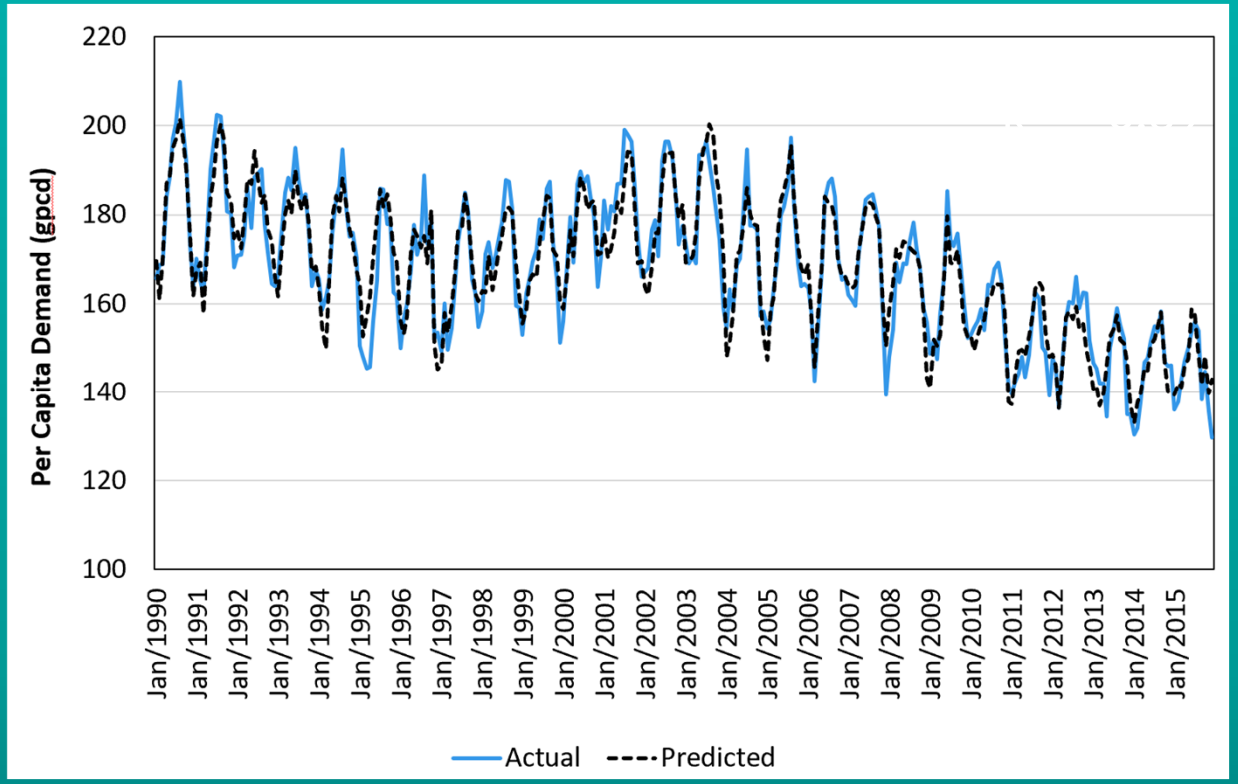
Water Availability Vulnerabilities

WATER DEMAND

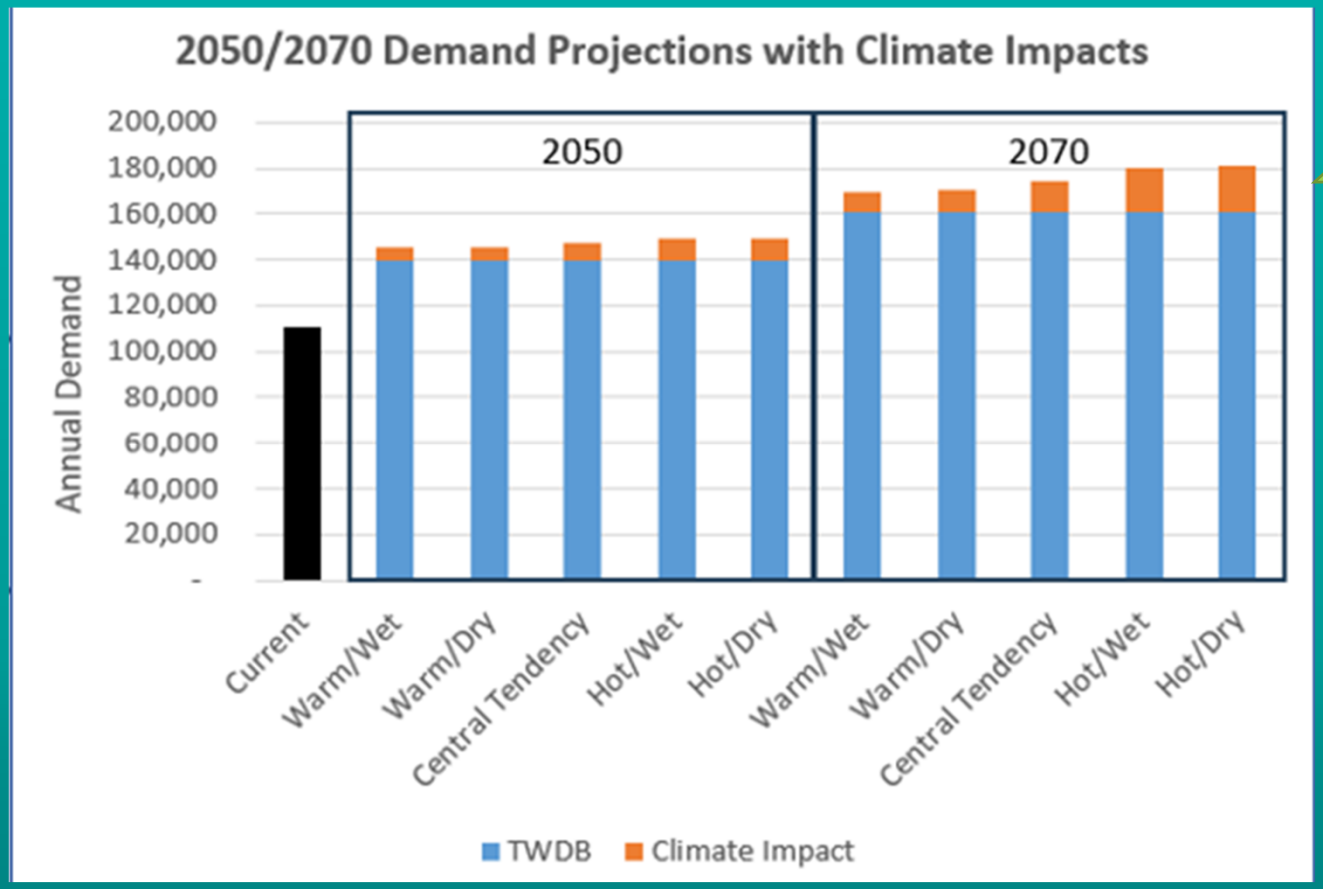
- Higher temperatures, more evaporation, less rainfall = Higher water demand
- How do we capture demand increases due to climate change?

WATER DEMAND REGRESSION MODEL

- Climate variables
  - Consecutive days without rain
  - Maximum monthly temperatures
  - Monthly precipitation
  - Previous month precipitation
- Non-Climate variables
  - Local economy
  - Average price of water
  - Plumbing efficiency
  - Increased active conservation



EXAMPLE – CLIMATE CHANGE DEMAND MULTIPLIERS



Up to 20% Increase in Demand

HOW WILL CLIMATE CHANGE AFFECT OUR WATER SYSTEM?

Climate Stressors

Chronic

- Reduced Rainfall and Droughts
- Sea Level Rise and High Tides
- Increasing Temperatures

Acute

- Sea Level Rise and Storm Surge
- Extreme Rainfall and Flooding
- Hurricanes
- Extreme Heat
- Wildfires

System Elements

- **Demand Forecasting**
- **Source Analysis**
- **System Infrastructure**
- **System Operation**

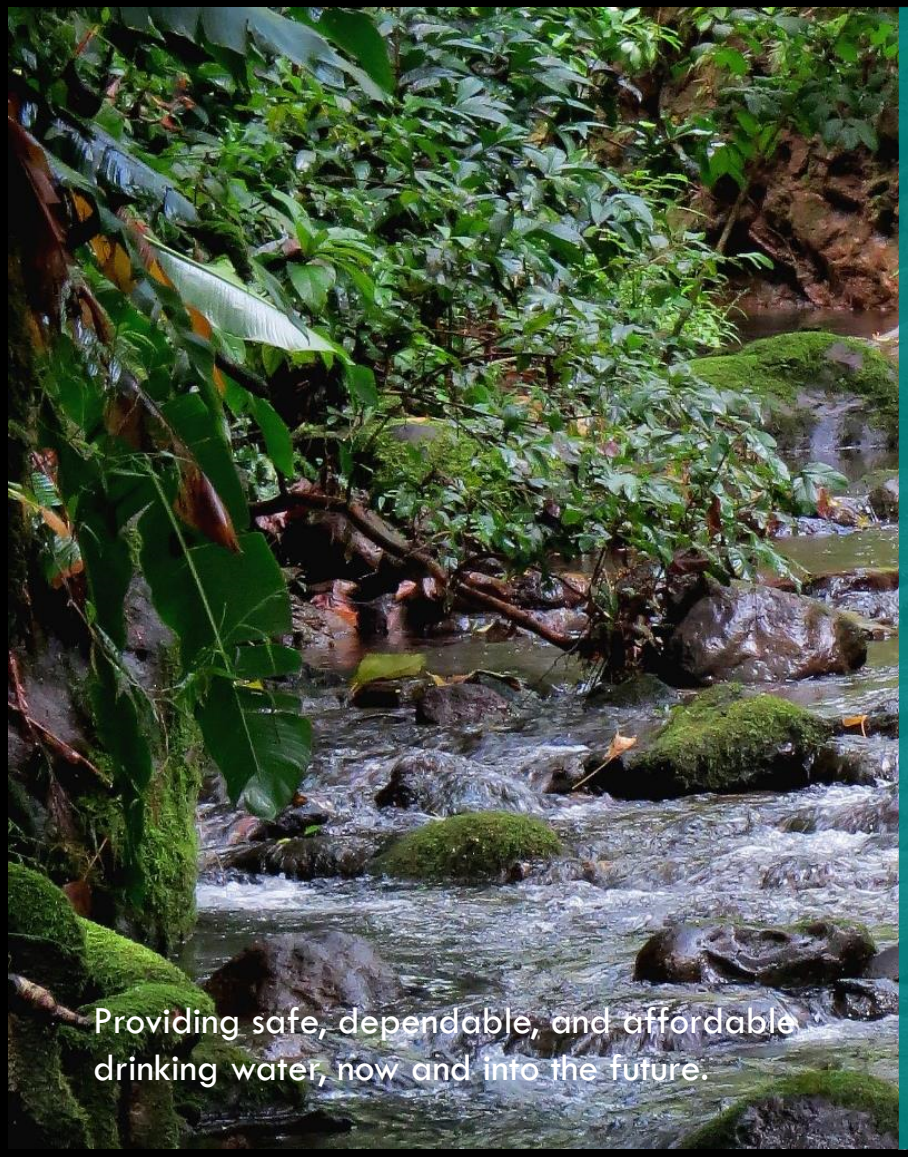
System Impacts

- Demand Increases
- Yield Impact (Droughts)
- Water Quality
- Regulatory Compliance (instream flow standards)
- Infrastructure at risk (flood, fire, wind)
- Treatment Process (operational changes)
- Distribution System
- Annual/ Seasonal Operational Adjustments

INTEGRATING CLIMATE CHANGE INTO THE WMP

- Acute and chronic climate stressors
- Climate change drives capital projects and costs
- Opportunities for improving infrastructure and operational efficiencies

QUESTIONS AND DISCUSSION



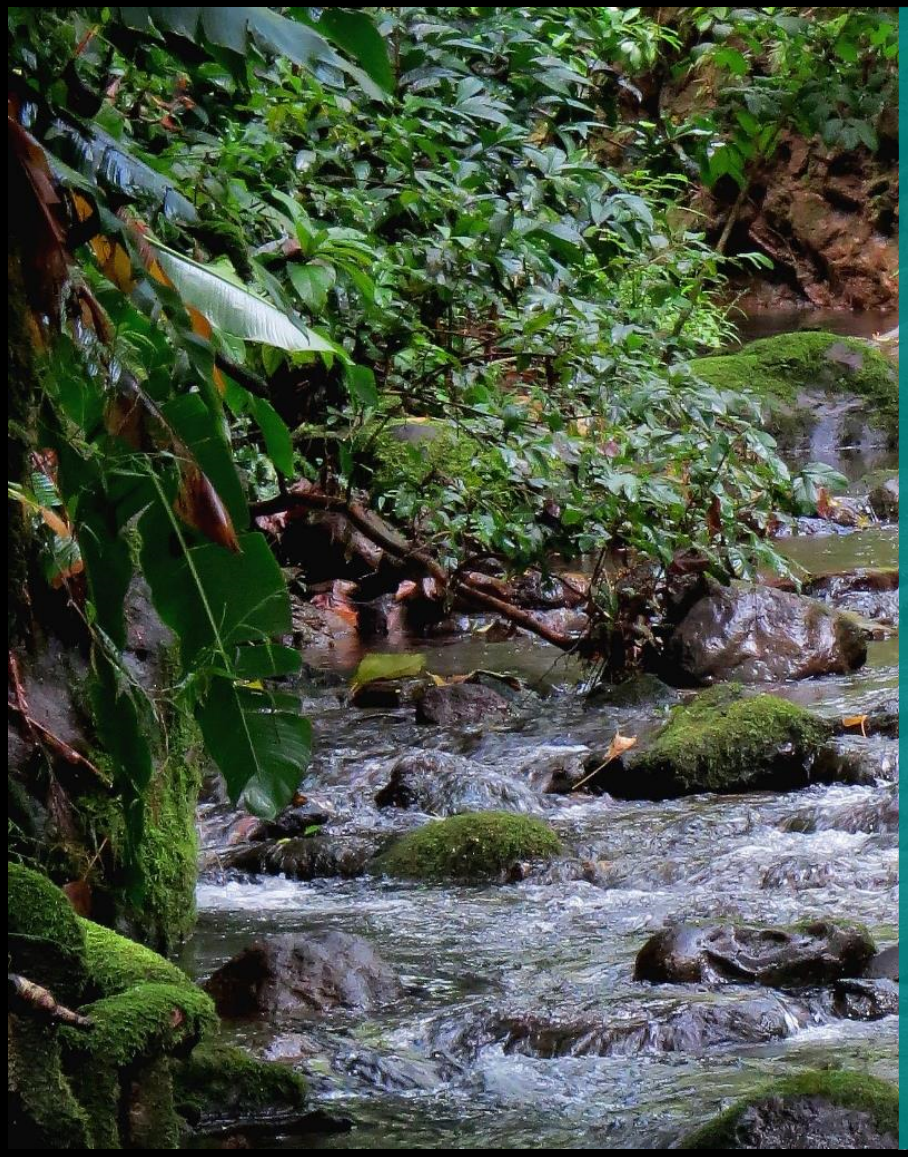
Providing safe, dependable, and affordable drinking water, now and into the future.

Mahalo!

ACCEPT MEETING NOTES FROM MEETING 52

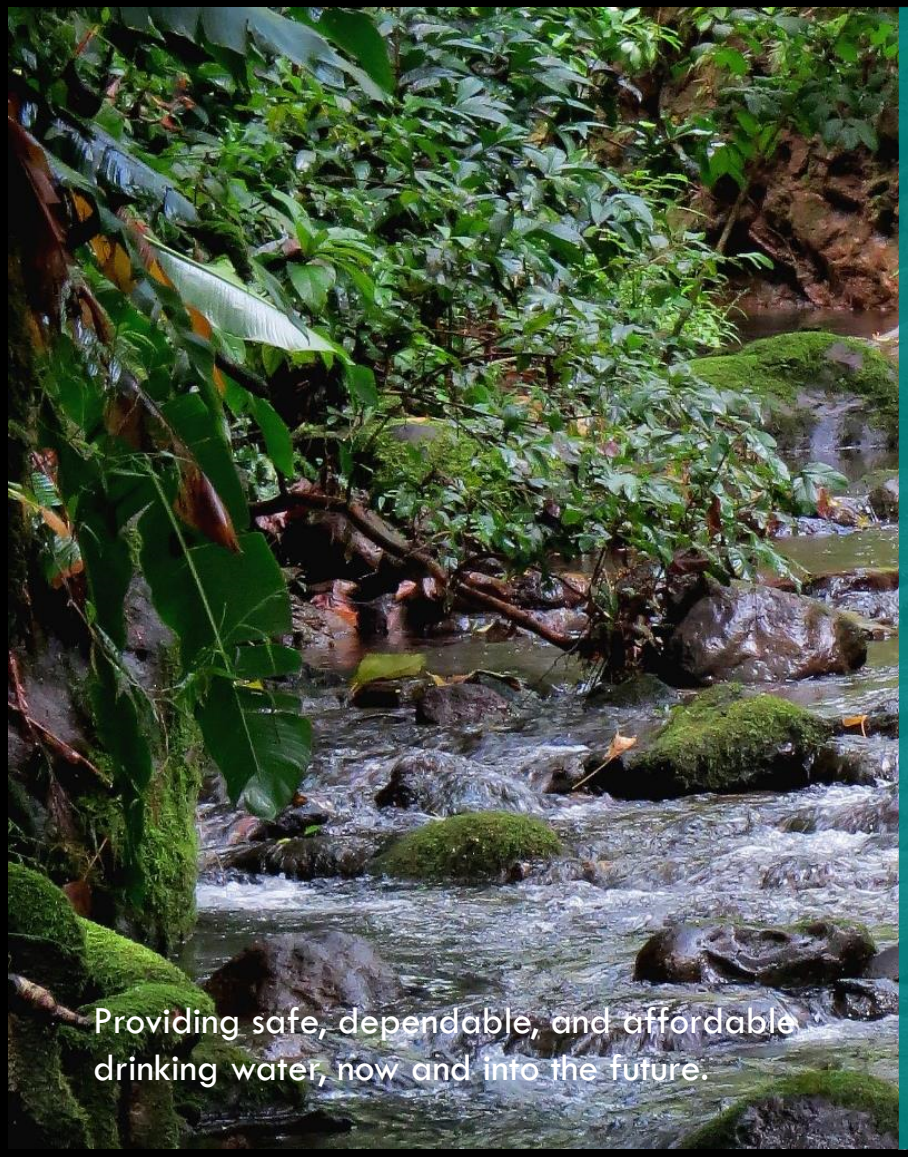
David Ebersold
Facilitator

January 16, 2025
www.boardofwatersupply.com



RED HILL UPDATES

Ernest Lau
Manager and Chief Engineer
January 16, 2025
boardofwatersupply.com



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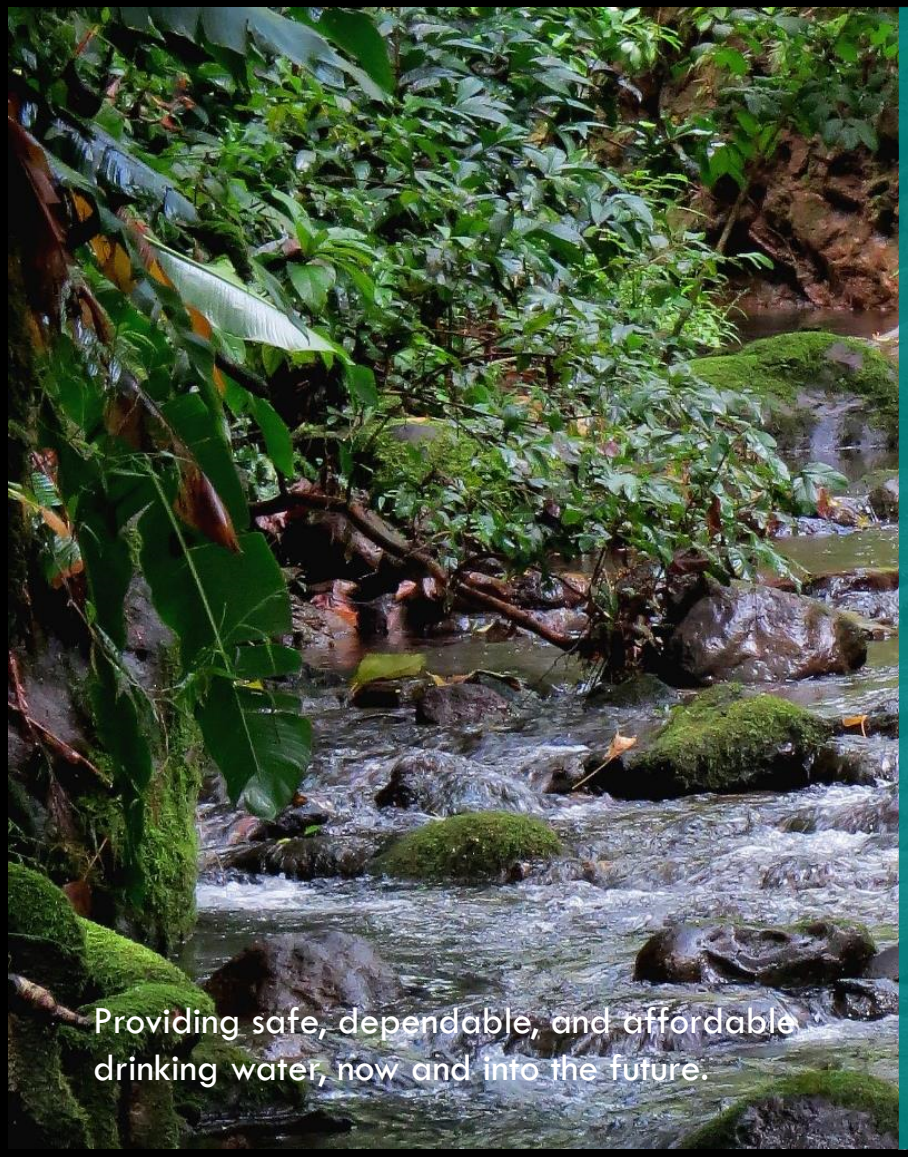
Mahalo!

UPCOMING STAKEHOLDER ADVISORY GROUP MEETINGS

2025

- Thursday, April 17, 2025
- Thursday, July 17, 2025
- Thursday, October 16, 2025



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