

Hawaii Water Audit Validation Effort (WAVE) Program Update

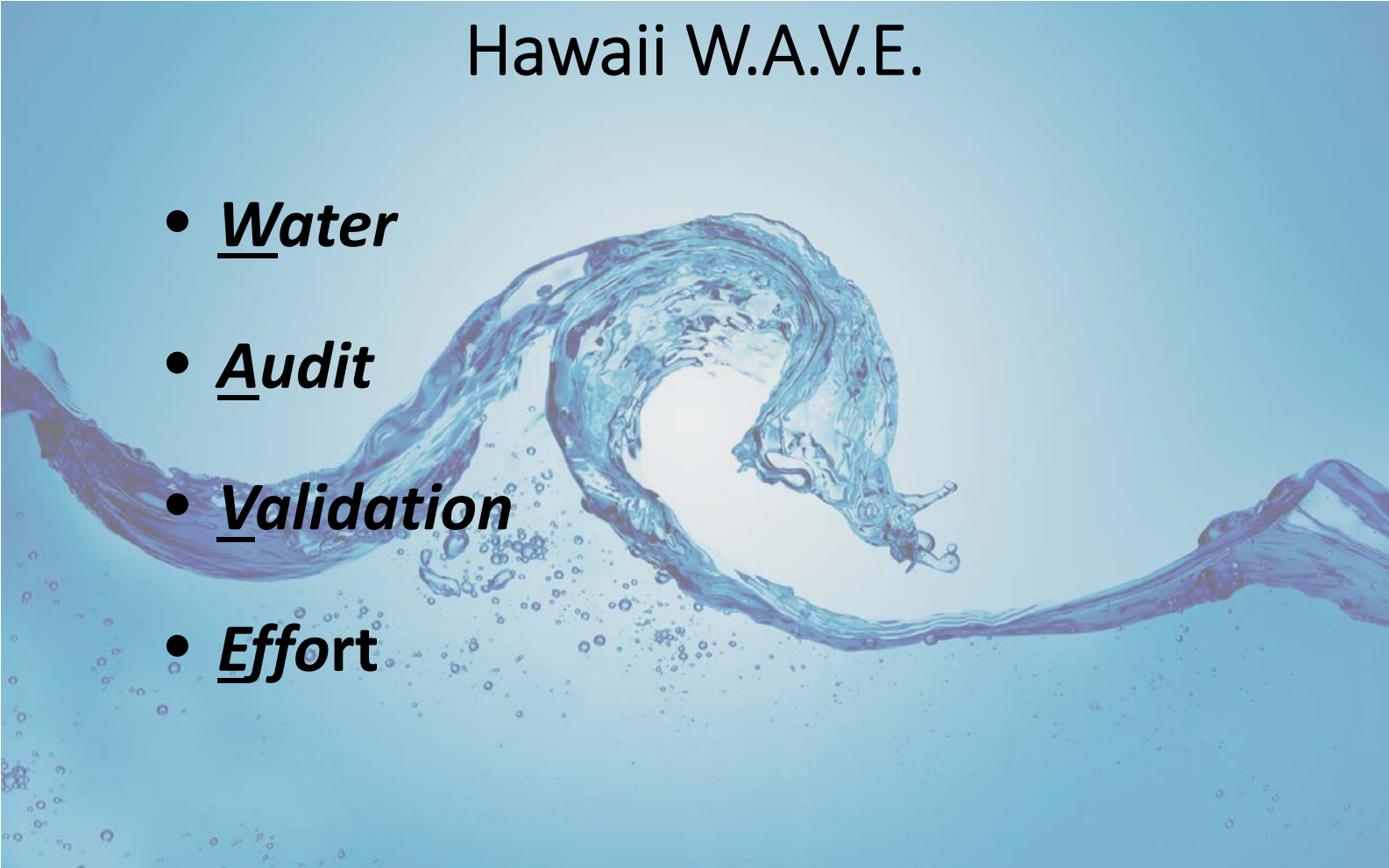


August 29, 2018
Kahului, HI



Hawaii W.A.V.E.

- **Water**
- **Audit**
- **Validation**
- **Effort**



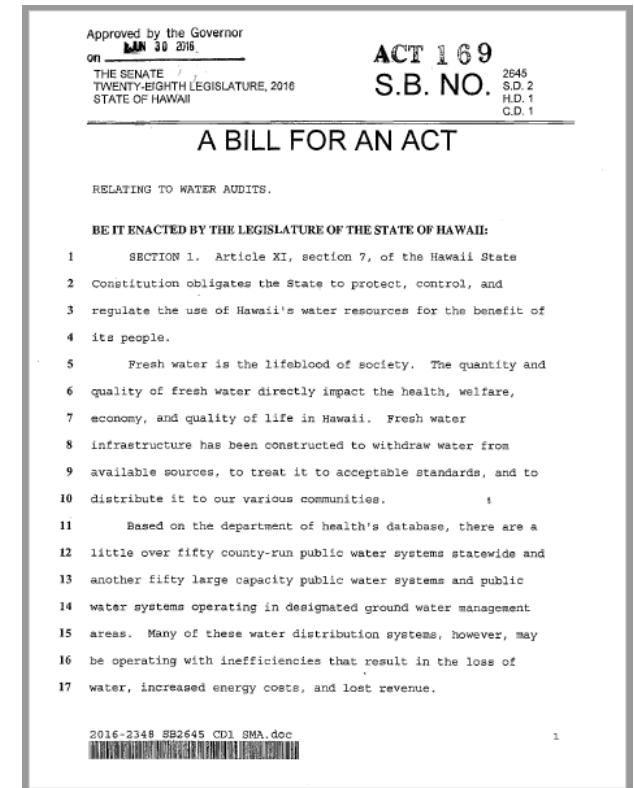
Overview

- Act 169, SLH 2016, Requirements
- Hawaii WAVE Program
 - County-owned audit results
 - Large-capacity/WMA systems update
- Next steps



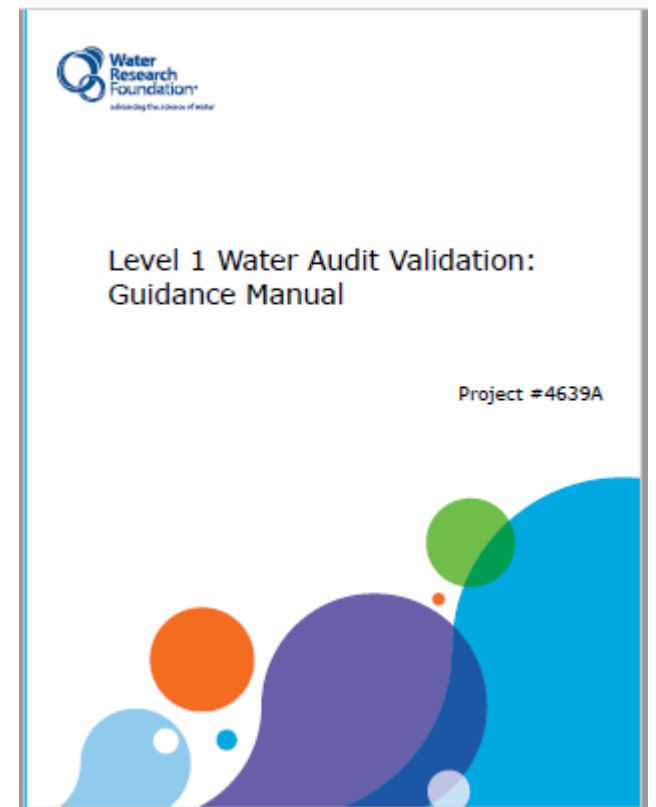
Act 169, SLH 2016, Relating to Water Audits

- Act 169 helps to implement the Commission's Water Conservation Plan (2013)
- Requires Commission to implement water audit program
- Commission will provide technical assistance & training at no cost to the utility (i.e., FREE!)
- Affects ~100 public water systems
 - 1st County-owned
 - 2nd Large capacity (serving population ≥ 1000) or within designated water management areas
- Annual validated audits are due to the Commission on July 1



Act 169, SLH 2016, Relating to Water Audits

- **Phase 1** County water audits due July 1, 2018
- **Phase 2** Large Capacity & WMA water audits due July 1, 2020
- AWWA water audits must be Level 1 Validated

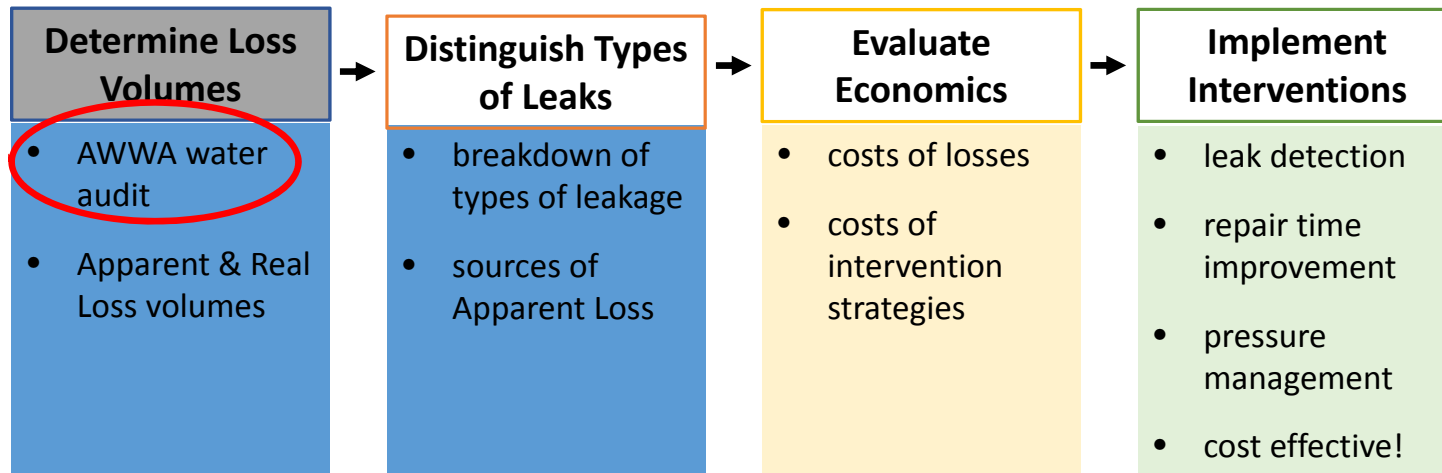


Act 169, SLH 2016, Relating to Water Audits

- Act 169 authorizes \$600,000 federal and \$100,000 private funding
- U.S. Environmental Protection Agency / Hawaii Department of Health / Hawaii Community Foundation
- Contract with Water Systems Optimization, Inc. to assist Commission



Water Loss Control Program



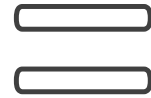
Benefits of Water Loss Control



Water



Money



Data

AWWA Water Balance

Water Supplied 100	Authorized Consumption 90	Billed Authorized Consumption 80	Billed Metered Consumption 75	Revenue Water 80
			Billed Unmetered Consumption 5	
		Unbilled Authorized Consumption 10	Unbilled Metered Consumption 8	Non-Revenue Water 20
		Unbilled Unmetered Consumption 2		
	Water Losses 10	Apparent Losses 3	Unauthorized Consumption 1	
			Customer Metering Inaccuracies 1	
			Systematic Data Handling Errors 1	
		Real Losses 7		



AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0

American Water Works Association.
Copyright © 2014, All Rights Reserved.

- ? Click to access definition
- + Click to add a comment

Water Audit Report for: Department of Water Supply (Central)
Reporting Year: 2018 7/2017 - 6/2018

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: **MILLION GALLONS (US) PER YEAR**

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below

WATER SUPPLIED

←----- Enter grading in column 'E' and 'J' ----->

Volume from own sources:	+	?	1	8579.77	MG/Yr
Water imported:	+	?	n/a		MG/Yr
Water exported:	+	?	n/a		MG/Yr

Master Meter and Supply Error Adjustments

	Pcnt:		Value:	
+	?	3	● ○	
+	?		● ○	
+	?		● ○	

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 8,579.770 MG/Yr

AUTHORIZED CONSUMPTION

Billed metered:	+	?	5	7,315.016	MG/Yr
Billed unmetered:	+	?	7	0.170	MG/Yr
Unbilled metered:	+	?	n/a	0.000	MG/Yr
Unbilled unmetered:	+	?	5	21.449	MG/Yr

Click here: ?
for help using option
buttons below

	Pcnt:		Value:	
○ ●	○ ●	○ ●	21.449	MG/Yr

Use buttons to select
percentage of water
supplied
OR
value

AUTHORIZED CONSUMPTION: 7,336.635 MG/Yr

WATER LOSSES (Water Supplied - Authorized Consumption) 1,243.135 MG/Yr

Apparent Losses

Unauthorized consumption: 21.449 MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	+	?	3	466.916	MG/Yr
Systematic data handling errors:	+	?		18.288	MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

	Pcnt:		Value:	
0.25%	● ○	○ ●		MG/Yr

	Pcnt:		Value:	
6.00%	● ○	○ ●		MG/Yr
0.25%	● ○	○ ●		MG/Yr

Instructions

Reporting Worksheet

Performance Indicators

Comments

Water Balance

Dashboard

Grading Matrix

Service Connection ... +

Types of Water Loss

Apparent Losses



Real Losses



Hawaii WAVE is a Water Audit Training and Technical Assistance Program

WAVE 1: Outreach & Introductory workshops

WAVE 2: Follow-up conference calls

WAVE 3: Outreach & Intermediate workshops

WAVE 4: Follow-up conference calls

Phase 1 County-owned Public Water Systems

- **WAVE 1: Conducted five 2-day workshops in 4 counties**
 - Day 1: Introduction to water audits, AWWA Water Audit Spreadsheet, data review
 - Day 2: Identification of system boundaries, sources of water supplied, customer meter records, practice audits
 - Trained 32 individuals from four county water departments
 - Delineated 45 discrete sub-systems
 - Kauai – 9
 - Oahu – 5
 - Maui – 10
 - Hawaii – 21



Phase 1 County-owned Public Water Systems

- WAVE 2: Completed follow-up teleconferences, data and validation review, received completed audits on time from all counties, technical memos
- WAVE 3: Completed workshops February-March 2018; “official” audit preparation
- WAVE 4: Completed validation calls and evaluated supporting documentation
- All inaugural water audits submitted by July 1, 2018

Hawaii WAVE Phase 1 Results

35 Systems

\$16.9 M



4,038 Miles of Mains

7 MGD Apparent Loss

24 MGD Real Loss

W S O

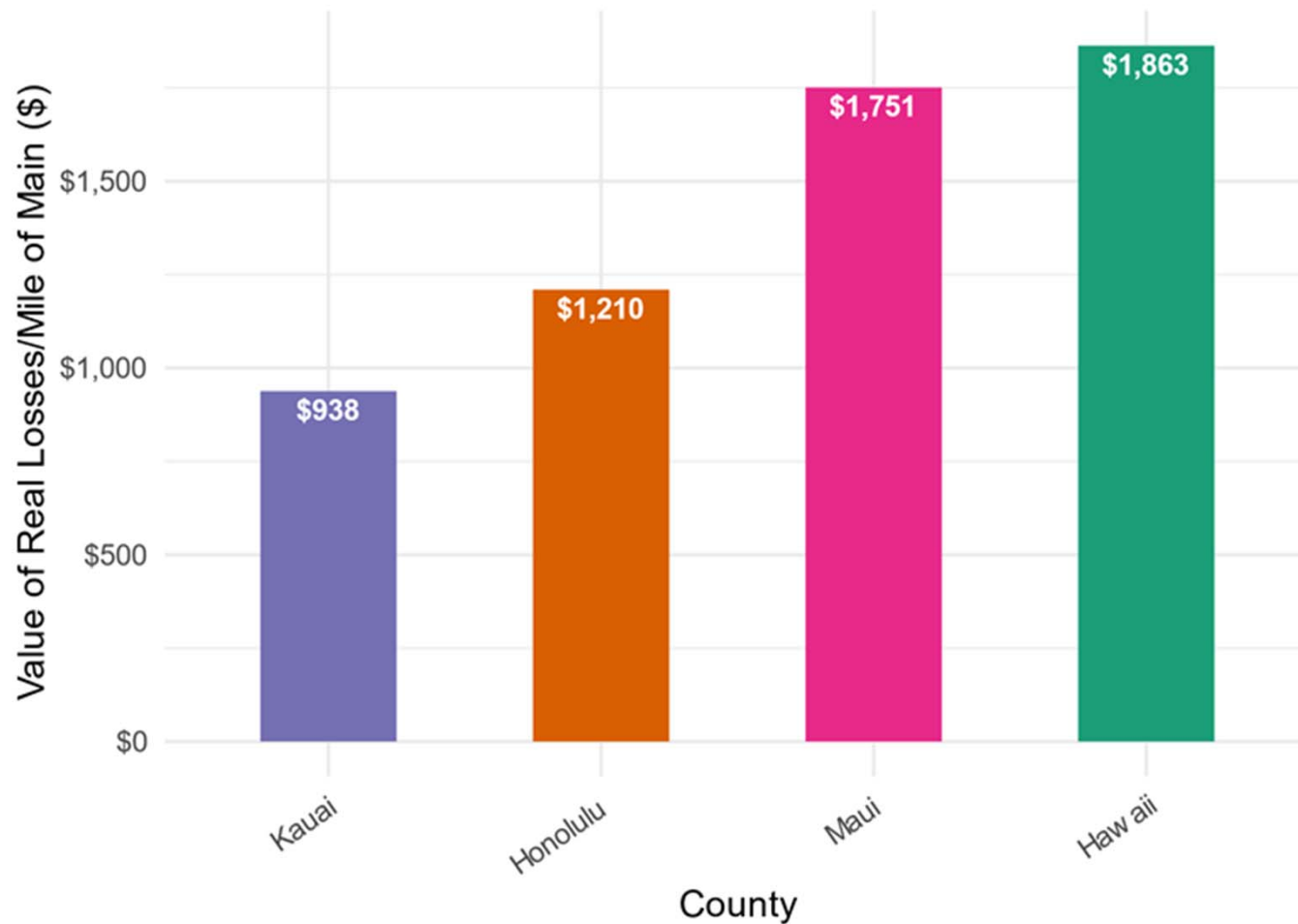
Real Loss Results

Summary of Real Loss Performance Indicators by County (CY2017)

County	Count of System Audits	Total Rate of Real Loss (MGD)	Total Cost of Real Losses (\$/yr)	Real Losses per Service Connection (gal./con/day)	Real Losses per Mile of Main (gal./mile/day)	Cost of Real Losses per Mile of Main (\$/mile/yr)
Hawaii	16	4	\$1,786,451	214	4,566	\$1,863
Honolulu	4	16	\$2,352,716	97	8,077	\$1,210
Kauai	6	1	\$347,117	61	3,148	\$938
Maui	9	3	\$1,338,185	79	3,738	\$1,751
Total	35	24	\$5,824,469	101	5,970	\$1,443

* Audits presenting unrealistic results have been removed from this summary.

Wave 4 Normalized Real Loss Results by County



Apparent Loss Results

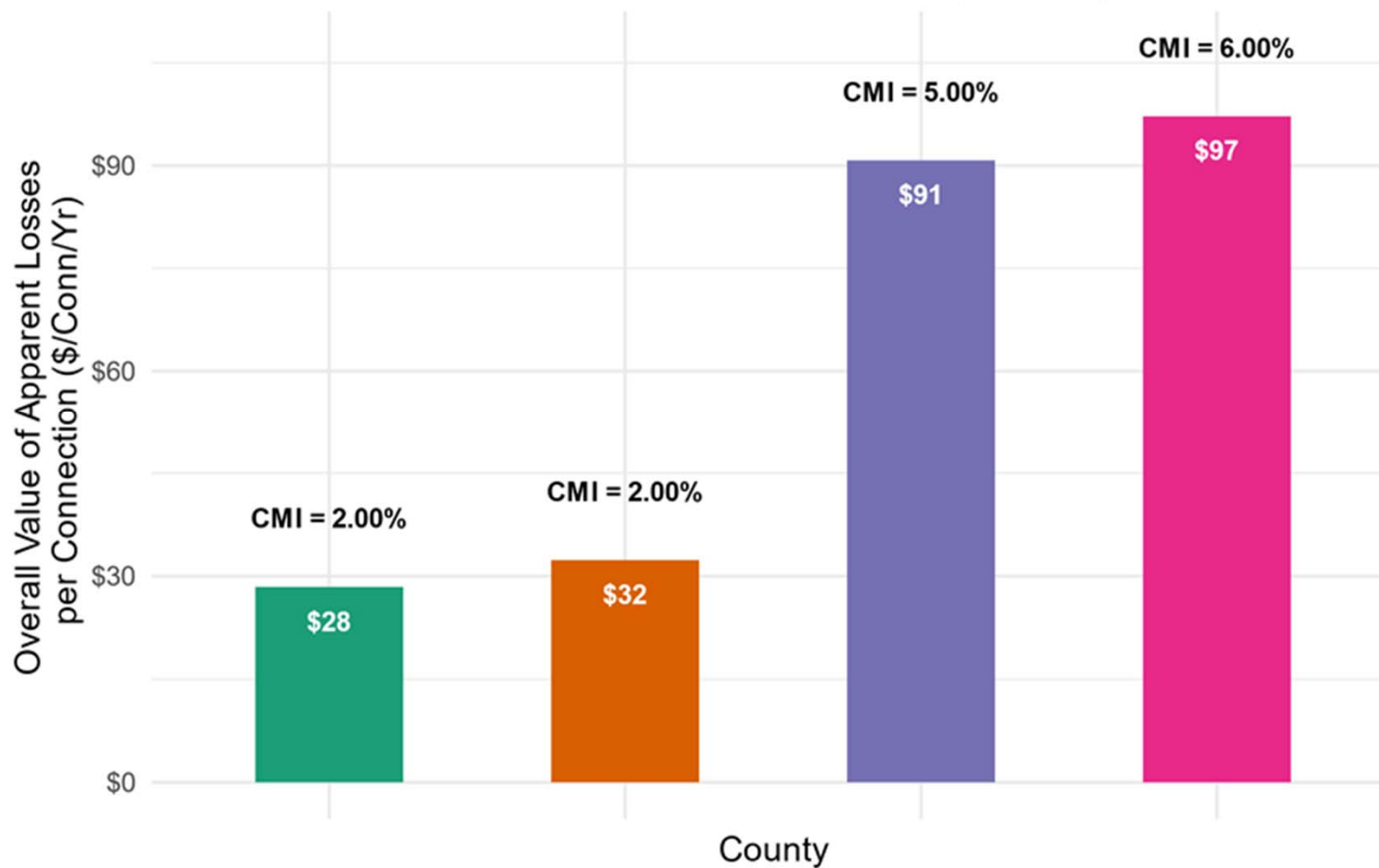
Summary of Apparent Loss Performance Indicators by County (CY2017)

County	Count of System Audits	Customer Metering Inaccuracy (%)	Total Rate of Apparent Loss (MGD)	Total Cost of Apparent Losses (\$/yr)	Apparent Losses per Connection per Day (gal/con/day)	Cost of Apparent Losses per Connection per Year (\$/con/yr)
Hawaii	16	5%	1.4	\$1,856,551	68	\$91
Honolulu	4	2%	3.1	\$5,249,221	19	\$32
Kauai	6	2%	0.3	\$539,910	14	\$28
Maui	9	6%	2.2	\$3,510,310	60	\$97
Total	35	-	7	\$11,155,991	29	\$47

* System audits presenting unrealistic results have been excluded from this summary

Wave 4 Apparent Loss Results by County

Wave 4 Normalized Value of Apparent Loss by County



Common Opportunities Phase 1 County-owned PWS

Data Management

- Regular master meter volumetric testing and calibration
- Customer meter testing program development
- Billing database auditing - detailed review of underlying raw consumption data

Real Loss Recovery

- Data management refinements will likely take priority over loss recovery
- Pressure surveys to assess opportunities to modify pressure and mitigate transients
- Comprehensive leak detection surveys to proactively find leaks for repair

Apparent Loss Recovery

- Customer meter testing program development

Hawaii WAVE is a Water Audit Training and Technical Assistance Program

WAVE 1: Outreach & Introductory workshops

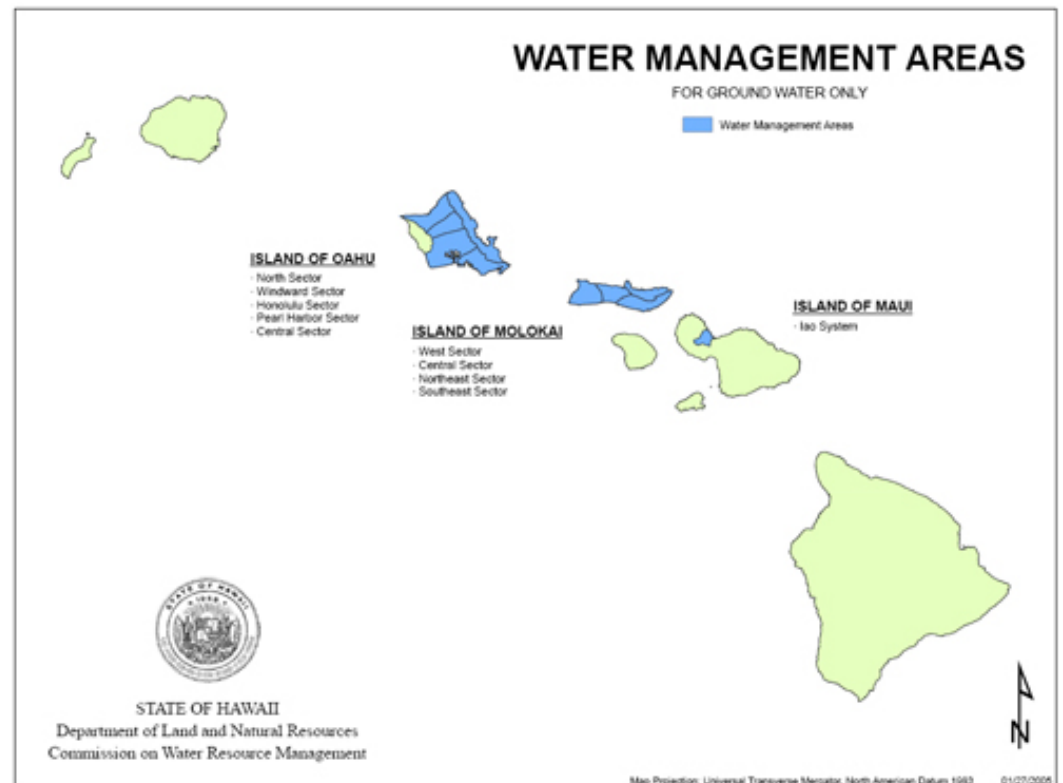
WAVE 2: Follow-up conference calls

WAVE 3: Outreach & Intermediate workshops

WAVE 4: Follow-up conference calls

Phase 2 Large Capacity & WMA Public Water Systems

- **51** PWS in four counties
- Kauai – 4
- Oahu – 30
- Maui – 6
- Lanai – 1
- Molokai -5
- Hawaii - 5



Phase 2 Large Capacity / WMA Public Water Systems

- WAVE 1: Conducted eight 1-day workshops on all islands Feb. – Apr. 2019
 - **48** PWS represented
 - 77 individuals trained
- WAVE 2: Validation follow-up calls Apr. – Jul. 2019
 - **41** PWS validation calls completed
 - 25 follow-up documents completed
 - Awaiting “practice audit” results

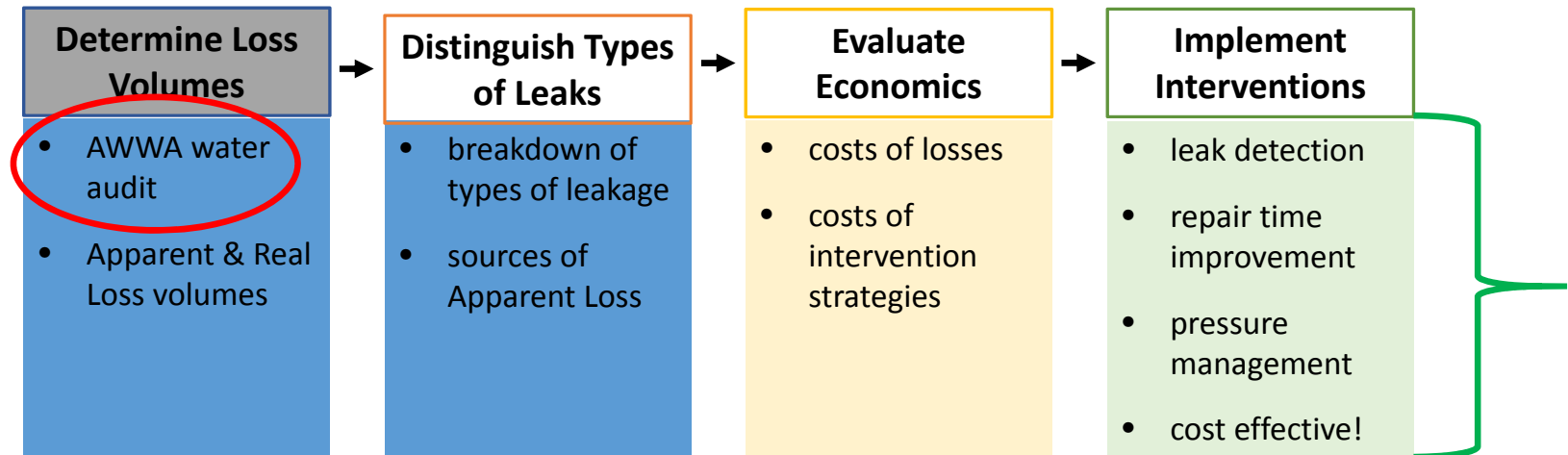


Lessons & Challenges – Phases 1 & 2

- Early outreach to industry is important – communication is key for buy-in
- Support from utility upper management critical
- Utility audit team should include management, ops, engineering, billing/finance, IT
- Practically no source meter testing / meter installation quality control
- We're here to help: utilities are apprehensive
- Large-capacity PWS includes non-utilities: school & hospital campuses; national parks
- AWWA water audit not ideally-suited for non-utility PWS
- Military PWS not participating



Water Loss Control Program



Common Opportunities Phase 1 County-owned PWS

Data Management

- Regular master meter volumetric testing and calibration
- Customer meter testing program development
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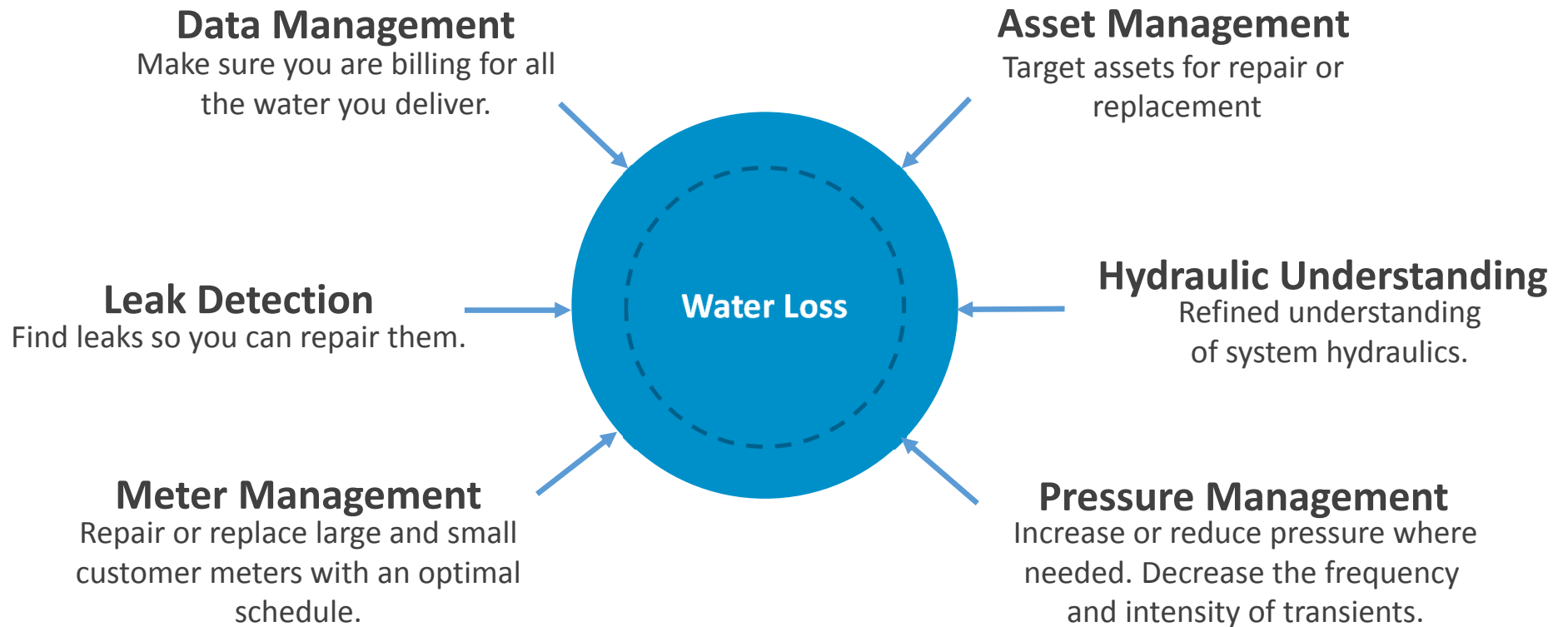
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Apparent Loss Recovery

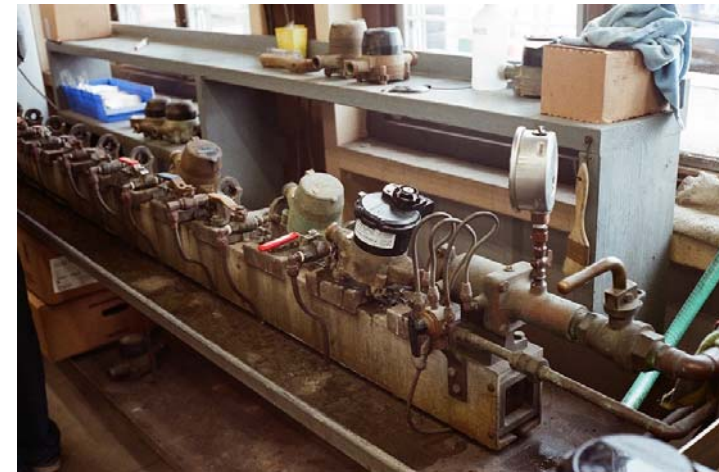
- Customer meter testing program development

Water Loss Control Benefits



Opportunities for Project Implementation

- Hawai'i DOH DWSRF loans
- Bureau of Reclamation WaterSMART grants
- Hawai'i Rural Water Association
- Rural Community Assistance Corporation
- Utility hui to leverage resources
- USDA Natural Resources Conservation Service programs??



Next Steps

- Continue to implement water audit program, monitor trends and review PWS steps to improve DVG and address system losses
- Motivate utilities to improve DVG and control water loss
- Update briefing to Water Loss Control Committee
- Pacific Water Conference 2020
- Reevaluate Act 169 requirements



Mahalo

Questions?

Benefits of Water Loss Control

- Conserve water and energy
- Improve sustainability
- Defer source development
- Build credibility with ratepayers & stakeholders

Opportunities for Project Implementation

- Hawai'i DOH DWSRF loans
- Bureau of Reclamation WaterSMART grants

**PHASE 2 LARGE CAPACITY PWS AND PWS IN WATER
MANAGEMENT AREAS**

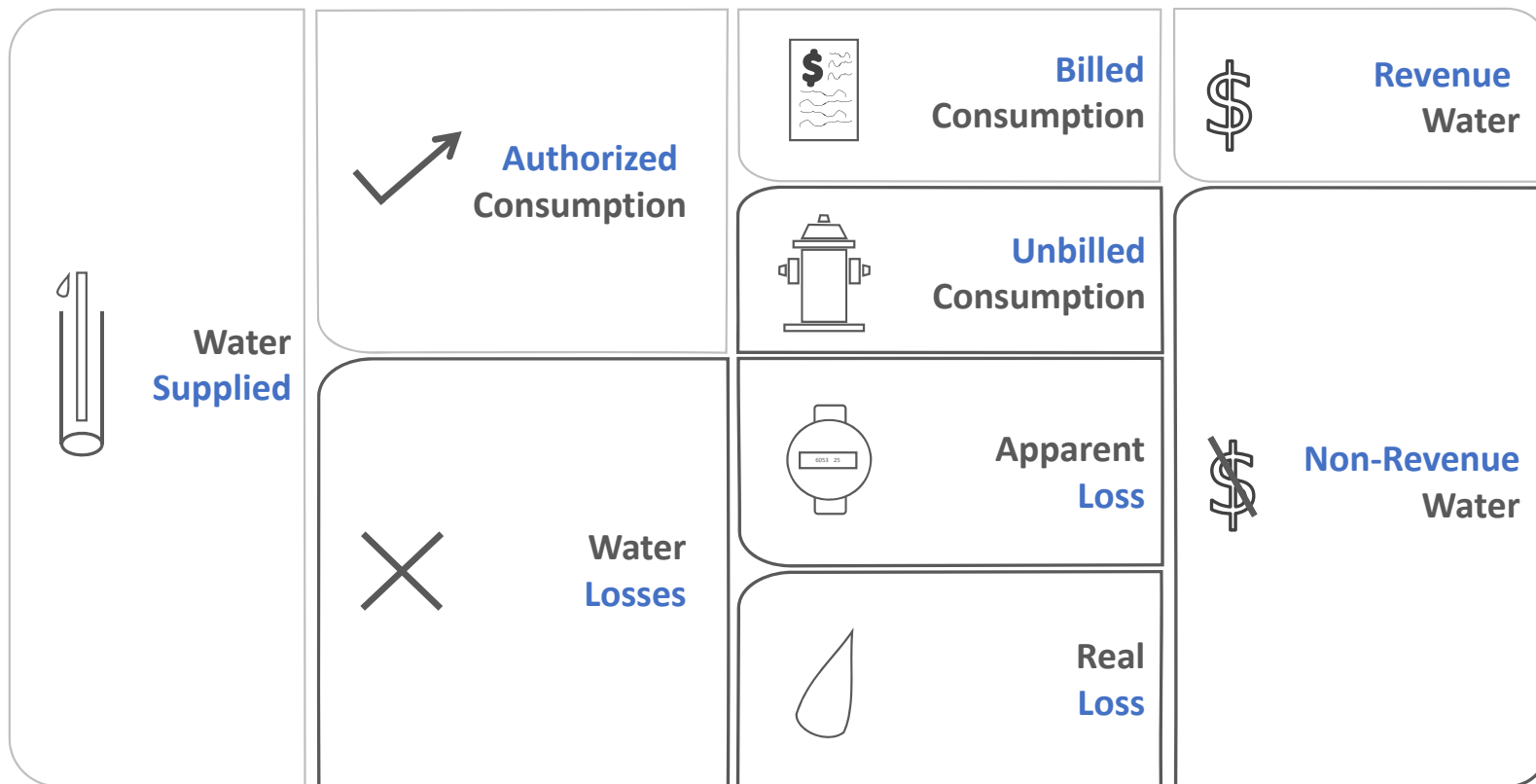
			POP	SVC
117	Hawaiian Beaches	Hawaiian Beaches Water Company, Inc.	3430	1065
		Hawaii Water Service Company	1210	
135	Waikoloa	U.S. Dept. of Interior	0	2446
146	Hawaii Volcanoes Nat.Park	Hawaiian Shores Association	3374	76
156	Hawaiian Shores	Kaupulehu Water Company	1310	450
163	Kaupulehu	Kapalua Water Co., Ltd.	1760	390
204	Kapalua	Hawaii Water Service Company	4200	555
205	Kaanapali	National Park Service	8000	700
222	Haleakala National Park	Waiola O Molokai	1200	17
229	Kualapuu	Dept of Hawaiian Home Lds	500	172
230	Hoolehua	Waiola O Molokai/MPU	1900	460
231	Maunaloa-Kaluakoi	Pulama Lanai	1000	358
237	Lanai City	National Park Service	3000	1700
239	Kalaupapa NHP	Hawaii Nature Center	110	138
240	Hawaii Nature Center	Waiola O Molokai	75	3
245	Kipu	Kawela Homeowners Assn.	80	20
248	Kawela Plantation	National Park Service	520	156
260	Kipahulu	Kunia Village Title Holding Corp.	2000	4
303	Kunia Village	Hawaii Country Club	650	138
304	Hawaii Country Club	Department of Health	400	2
306	Waimano Ridge	Dole Food Co., Inc.	400	52
309	Waialua Sugar Pump 2	The Queen's Medical Center	400	120
312	The Queen's Medical Center	Roman Catholic Church,HI	3400	1
314	St. Stephen's Diocesan Center	Kahuku Water Association, Inc.	45	8
315	Kahuku Air Base	Kamehameha Schools	75	25
319	Kamehameha Schools	Mililani Memorial Park	4000	65
320	Mililani Memorial Park	Punahou School	100	1
324	Punahou School		4000	10

325	Laie Water Company	Laie Water Company	5577	700
		North Shore Water Company,		
326	Dillingham Ranch	LLC	100	58
328	Kipapa Acres C.P.R.	Kipapa Acres C.P.R.	43	15
330	Sheraton Hotels	Kyo-ya Co., Ltd.	2830	3
337	Aliamanu	US Army Dir of Public Wks	7513	545
338	Dillingham Airfield	Dept. of Transportation	1800	12
341	Fort Shafter	US Army Dir of Public Wks	8213	418
			4055	
345	Schofield Barracks	US Army Dir of Public Wks	8	1841
346	Tripler Army Medical Cntr	US Army Dir of Public Wks	5693	83
348	Waiawa Correctional Facility	Dept. of Public Safety	444	12
354	Camp Stover	NAVFAC Hawaii	595	200
355	Barbers Point	NAVFAC Hawaii	5256	1117
			1590	
356	Marine Corps Base Hawaii	U.S. Marine Corps	0	2555
357	NCTAMS EASTPAC	NAVFAC Hawaii	6470	186
			6523	
360	Joint Base Pearl Harbor-Hickam	NAVFAC Hawaii	0	7619
		Hawaii Housing Finance &		
368	Waiahole	Development Crp	300	104
370	Palehua Solar Observatory	Gill Ewa Lands, LLC	50	7
		Poamoho Water Association,		
371	Poamoho Estates	Inc.	50	13
372	Woodlands at Nuuanu	Woodlands at Nuuanu AOA	48	18
	The Queen's Medical Center			
373	West Oahu Potable	The Queen's Medical Center	800	5
417	Gay & Robinson	Gay & Robinson, Inc.	999	325
425	Kokee State Park	DLNR State Parks	2000	93
428	Princeville	Princeville Utilities Co., Inc	1698	1103
430	PMRF	U.S. Dept. of the Navy	1200	185

AWWA Water Audit Methodology

The water balance and water loss control benefits

Methods: AWWA Water Balance



Water Balance

Water Supplied 100	Authorized Consumption 90	Billed Authorized Consumption 80	Billed Metered Consumption 75	Revenue Water 80
			Billed Unmetered Consumption 5	
		Unbilled Authorized Consumption 10	Unbilled Metered Consumption 8	Non-Revenue Water 20
			Unbilled Unmetered Consumption 2	
	Water Losses 10	Apparent Losses 3	Unauthorized Consumption 1	
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			Systematic Data Handling Errors 1	
		Real Losses 7		

Performance Indicators



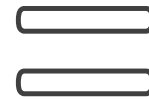
Volumes

Real & Apparent Losses
Real & Apparent Losses per Connection per Day
... per Connection per Day per PSI
Infrastructure Leakage Index



Values

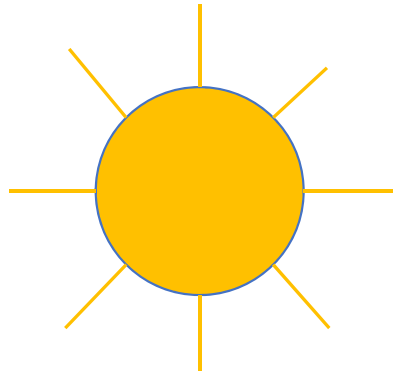
Cost of Real Losses
Cost of Apparent Losses



Validity

Data Validity Grades & Score

Performance Indicators – Percentages



Year 1

Water Supplied: 1000

Authorized Consumption: 900

Water Loss: **100**

Water Loss (%): **%10**



Year 2

Water Supplied: 800

Authorized Consumption: 700

Water Loss: **100**

Water Loss (%): **%14**

Performance Indicators – Infrastructure Leakage Index



$$LI = \frac{\text{Current Annual Real Losses}}{\text{Unavoidable Annual Real Losses}}$$

Level 1

Water Audit Validation

What it does and what it doesn't

Level 1 Validation

Goals: quality and consistency

1. Review audit methodology and input determinations
2. Verify Data Validity Grade selections

Guidance manual: Water Research Foundation 4639

The logo for 'Level 1 Water Audit Validation' features two semi-circular shapes at the top: a green one on the left and an orange one on the right. Below these shapes, the text 'Level 1 Water Audit Validation' is written in a blue, sans-serif font. A thin blue horizontal line is positioned directly under the text.


Level 1 Water Audit Validation

Project Number: 4639 • Date Available: November 2016

Principal Investigators: Lucy Andrews, Kate Gasner, and Reinhard Sturm, Water Systems Optimization; George Kunkel, Kunkel Water Efficiency Consulting; Will Jernigan and Steve Cavanaugh, Cavanaugh

Level 1 Validation

Quality Matters

inaccuracy &
uncertainty in
inputs  inaccuracy &
uncertainty in
results

Sources of error:

- Instruments
- Databases
- People
- Missing information

Level 1 Validation

Goals: Confirm interpretation of methodology
Identify evident errors
Assign appropriate data validity grades

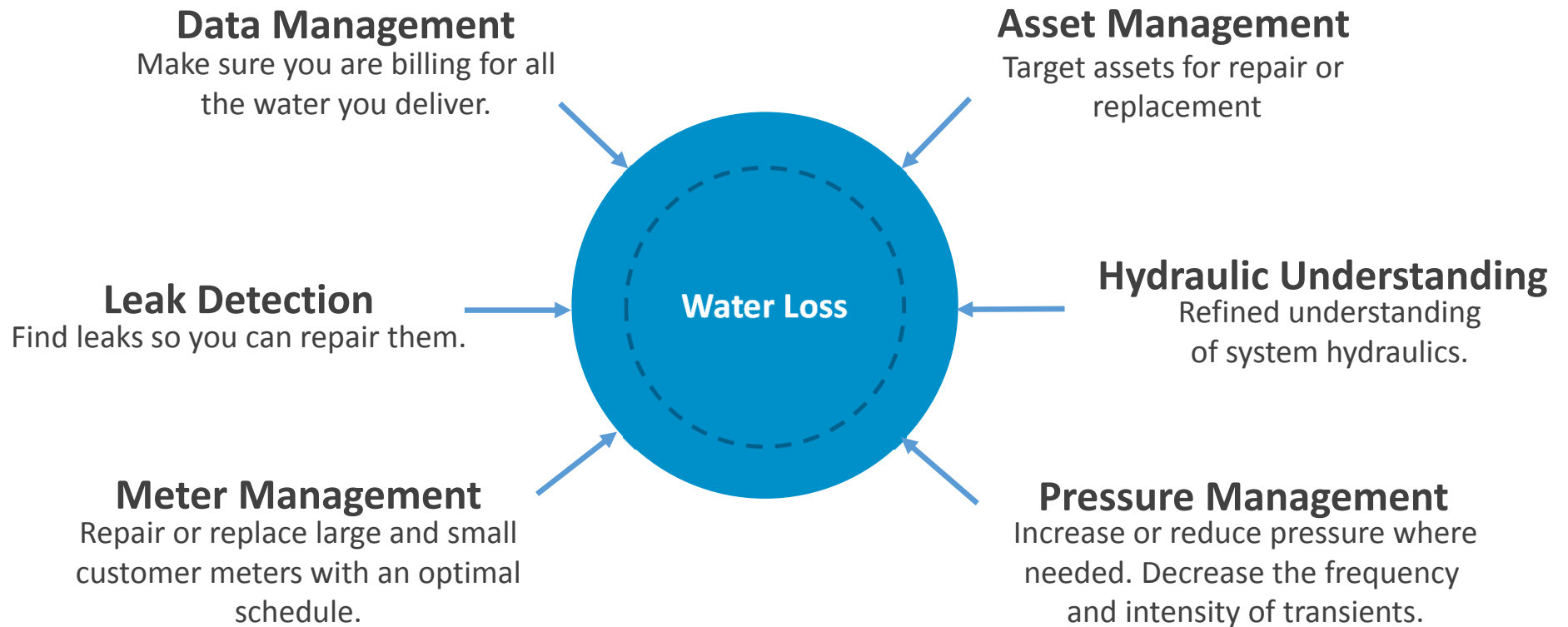
Outcomes: Appropriate data validity grades
Recommendations for further validation

Limitations: Does not correct errors in raw data
Does not study instrument performance

Level 1 Validation Documentation

- People – auditor and validator
- Initial performance indicators
- Validated performance indicators
- Recommended changes (audit inputs, data validity grades)
- Remaining questions
- **Recommendations for further validation**
- Overall impression

Water Loss Control Benefits



Thank YOU!