DISCUSION: A Comprehensive Assessment of the Delaware River Basin Commission's Water Audit Program (2012-2021)

Water Management Advisory Committee (WMAC)

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February 14, 2024

Delaware River Basin Commission
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UNITED STATES OF AMERICA

RECAP: Basin Highlights

- **Drains 13,539 square miles** in 4 states (0.4% USA land area)

- **14.2 million people** rely on the waters of the Delaware River Basin (about 4% of the 2020 U.S. population)

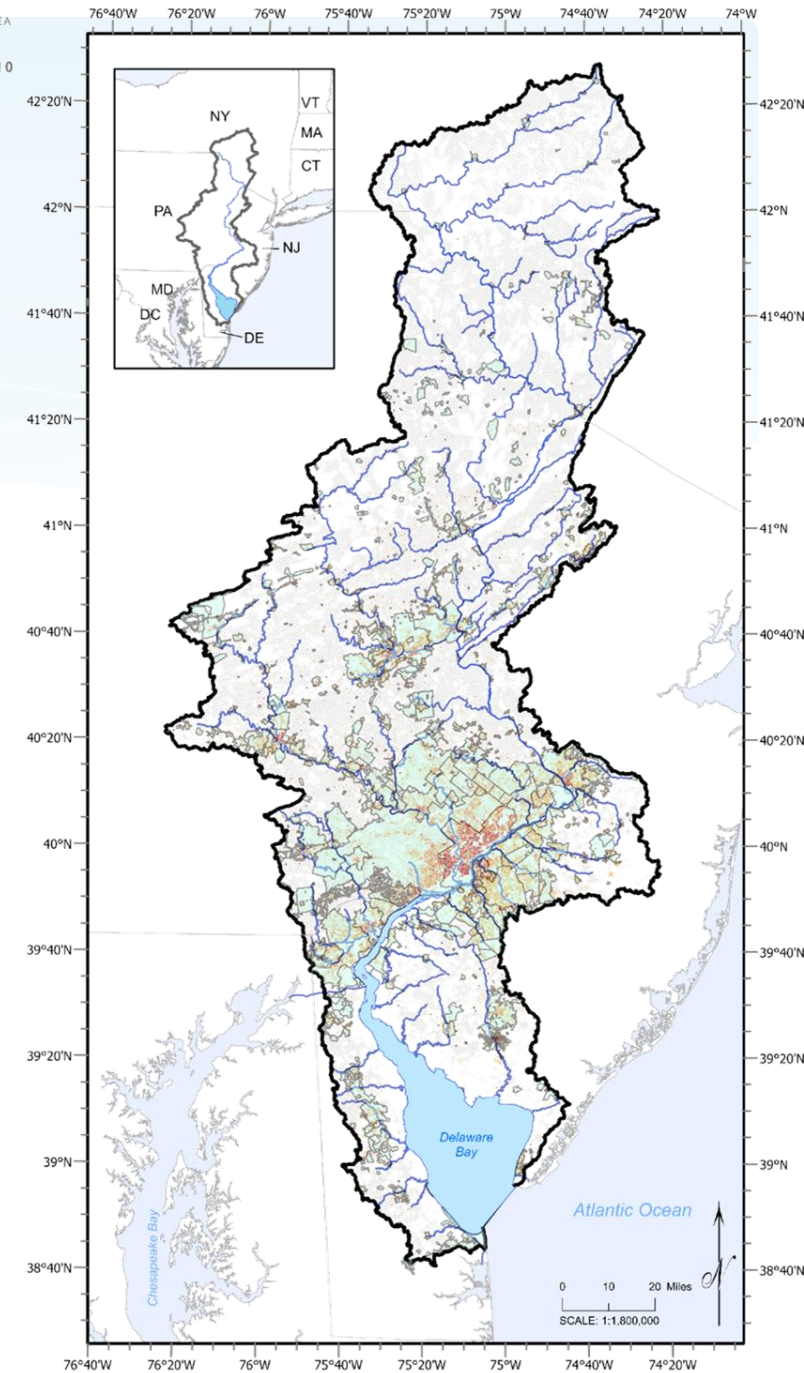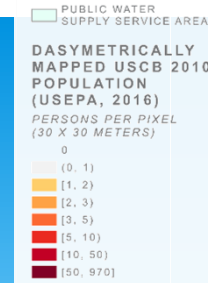**8.629 million people** live in Delaware River Basin (2020 Census)

7.366 million people live inside public water supply (PWS) service areas
- ~ *85% of the Basin population*
- ~ *911 Public Water System Identification (PWSID) numbers*

300 system subject to DRBC water audit requirements (328 PWSIDs)

29,000 miles of water main (enough to circle the Earth)

2.5 million service connections (active and inactive)

PUBLIC WATER
SUPPLY SERVICE AREA

DASYMETRICALLY
MAPPED USCB 2010
POPULATION
(USEPA, 2016)
PERSONS PER PIXEL
(30 X 30 METERS)
0
(0, 1)
[1, 2)
[2, 3)
[3, 5)
[5, 10)
[10, 50)
[50, 970)

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RECAP: DRBC water audit program highlights

Water Management Advisory Committee (WMAC) is formed by Resolution No. 98-21

Reviewed (1) IWA water audit methodology and (2) Delaware River Basin Water Code. Recommended the IWA methodology be adopted within the Basin

DRBC staff participated in an effort led by the AWWA Water Loss Control Committee (WLCC) to develop new software for implementing the water audit approach

Software approved by AWWA WLCC and posted on the AWWA website (FWAS)

- DRBC undergoes rulemaking process
- Adopted Res 2009-1 to amend Water Code
- Audit voluntary for CY2010 and CY2011
- Applies to systems which:

    "distribute water supplies in excess of an average of 100,000 gallons per day (gpd) during any 30-day period"

First mandatory audits required for CY2012

Published status reports based on audits results from CY2012, CY2014, CY2016

A Comprehensive Assessment of the Delaware River Basin Commission's Water Audit Program (2012-2021)
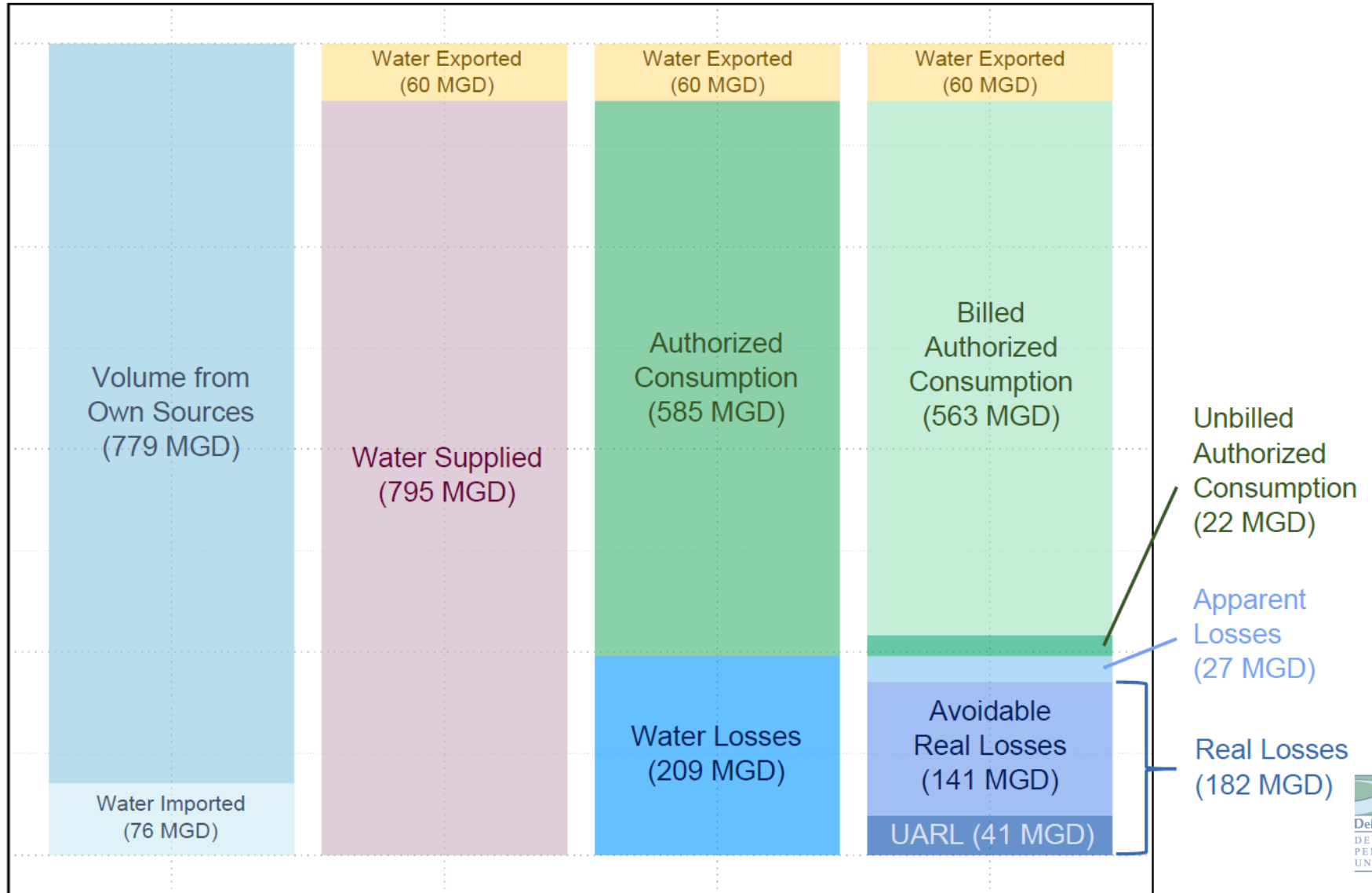
1998	2004-2005	2006	2007-2009	2012	2015-2018	2021-2023

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RECAP: CY2021 Water Audits

Figure ES-1: Aggregate water balance for 300 systems reporting water audit data to DRBC for CY2021. Note that the totals in the 3rd and 4th columns are 1 MGD less than the 1st and 2nd due to rounding when the data is disaggregated.

RECAP: RLRP

Public water supply withdrawals from the Delaware River Basin with comparison to the in-Basin population
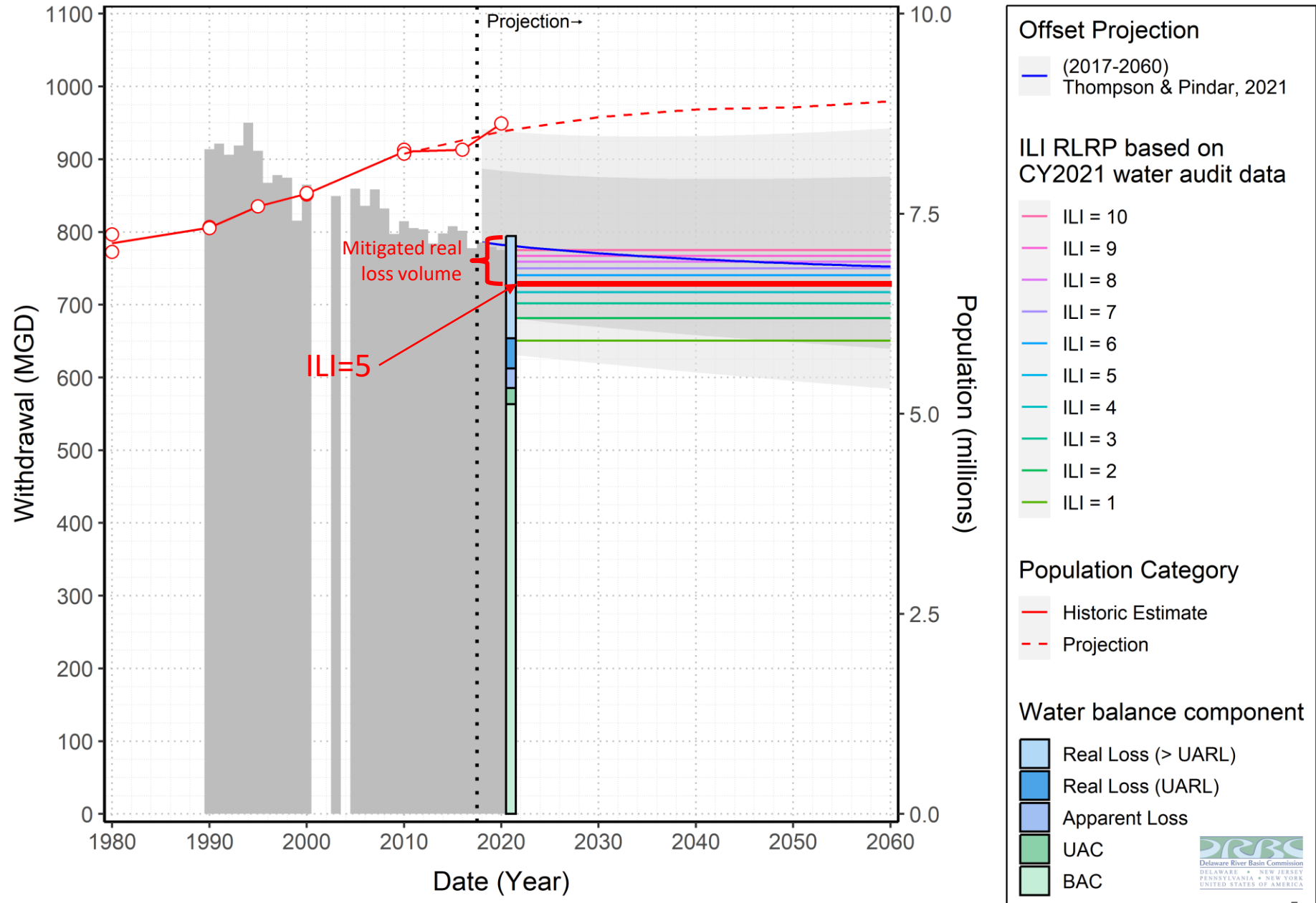
Figure ES-2: The projections from Thompson & Pindar, 2021 have been offset by about 33 MGD, equal to the error between the model and reported withdrawals in CY2017. Horizontal lines representing the ILI frontiers have been calculated for each ILI based on applying the real loss reduction potential (RLRP) to the CY2021 VOS.

Offset Projection
(2017-2060)
Thompson & Pindar, 2021

ILI RLRP based on CY2021 water audit data
ILI = 10
ILI = 9
ILI = 8
ILI = 7
ILI = 6
ILI = 5
ILI = 4
ILI = 3
ILI = 2
ILI = 1

Population Category
Historic Estimate
Projection

Water balance component
Real Loss (> UARL)
Real Loss (UARL)
Apparent Loss
UAC
BAC

Mitigated real loss volume

ILI=5

RECAP: Key messages from the study

1 **This study is the first of its kind**

…assessing a decade of water audit data compiled from water supply systems across four states, yielding insight as to how water loss control in the public water supply sector can relate to the water resources of the Delaware River Basin.

2 **Increased data & program maturity**

Through the water audit program, DRBC has compiled and now vetted a large dataset to support planning efforts at the Basin-scale.

3 **The current state of water loss**

The current state of water loss in the Delaware River Basin is assessed for CY2021 using data from the AWWA Free Water Audit Software reports from 300 water supply systems… Real water losses (i.e., leakage) are estimated to be 182 MGD, of which approximately 41 MGD are estimated to be unavoidable…. Ultimately, there is still room for improvement towards reducing the real losses that are above what is considered unavoidable.

4 **Established baseline**

This study provides a very strong baseline picture of the Basin. Continued use of this software (AWWA FWAS v6.0) will provide the best quality data such that those with the power to effectuate change can make informed decisions.

Discussion: Report recommendations

1. Improve data validity
2. Improve quality of financial data
3. Improve the water audit review process
4. Perform analyses on the Economic Level of Leakage
5. Incorporate System Correction Factors for UARL calculations
6. Use of UARL unit rate
7. Analysis of data on asset condition
8. Analysis of operational pressure variation data
9. Possible modifications to AWWA software
10. Investigate impacts on leakage due to COVID-19
11. Investigate financial and equity impacts of water loss
12. Investigate the relationship between source water temperature and leakage
13. Update the national groundwater temperature map

Discussion: Report recommendations

1. Improve data validity

It is recommended that the process of increasing the overall data validity of AWWA FWAS reports being submitted to DRBC annually be investigated, as well as the logistics for water audit report validation (e.g., Level 1 validation). Currently more than half of the reports are being submitted with a Data Validity Tier III or less (223/300), accounting for 371 MGD of water supplied, on average.

What is data validity?

Basically, how reliable is the data being entered into the AWWA FWAS?

- **Each parameter** on a scale from 1-10
- **Each audit** getting a score from 0-100

	WATER SUPPLIED:	77.392	MG/Yr

AUTHORIZED CONSUMPTION

Billed Metered:	n	g	7	80.048 MG/Yr
Billed Unmetered:	n	g	n/a	MG/Yr
Unbilled Metered:	n	g	4	MG/Yr
Unbilled Unmetered:	n	g	3	0.200 MG/Yr

r Unbilled Unmetered, with automatic data grading of 3

AUTHORIZED CONSUMPTION:	80.248	MG/Yr

lues; WATER SUPPLIED should be greater than AUTHORIZED C

WATER LOSSES	-2.856	MG/Yr

go to input · **Billed Metered Authorized Consumption (BMAC) - Data Grading Criteria** · go to notes

bmac	Criteria Question	Select Best-Fit Answers to All Visible Questions
bmac.0	Were any customers metered in the audit year?	Yes
bmac.1	For billed metered accounts, what % of bills are estimated in a typical billing cycle?	5% or less
bmac.2	How often does the utility read its customer meters? For systems with multiple read frequencies, select the reading frequency that describes the majority of your customers.	Quarterly
bmac.3	Is the BMAC volume pro-rated to represent consumption occuring exactly during the audit period?	Yes
bmac.4	How frequently does internal review by utility staff of the BMAC volumes occur?	Every billing cycle
bmac.5	What level of detail is examined in the internal review of BMAC volumes?	Totals grouped by use type or customer class and specific accounts flagged for anomalous consumption
bmac.6	When was the most recent billing data review by someone who is independent of the utility billing process?	More than 5 years ago, or not sure
bmac.7		

Limiting

Answer these

FINAL DATA GRADE FOR THIS AUDIT INPUT:	7

Get a score

WATER SUPPLIED

Volume from Own Sources:	n	1	80.712	MG/Yr
Water Imported:	n	g	n/a	MG/Yr
Water Exported:	n	1	3.320	MG/Yr

WATER SUPPLIED:	77.392	MG/Yr

# Discussion: Report recommendations

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DRB Data Validity?

Table 2: System size class definitions.

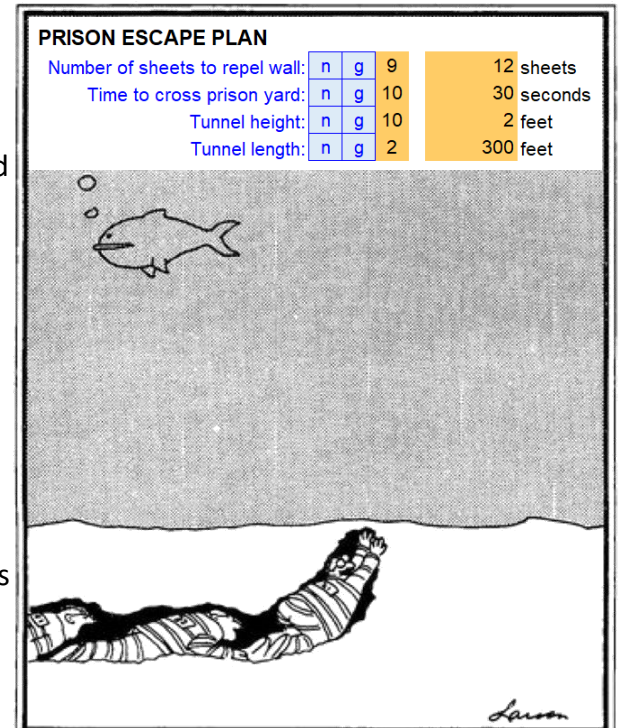| System size class	Abbv.	Active/Inactive Connections
Very Small	VS	< 1,000
Small	S	[1,000, 5,000)
Medium	M	[5,000, 10,000)
Large	L	[10,000, 20,000)
Very Large	VL	≥ 20,000
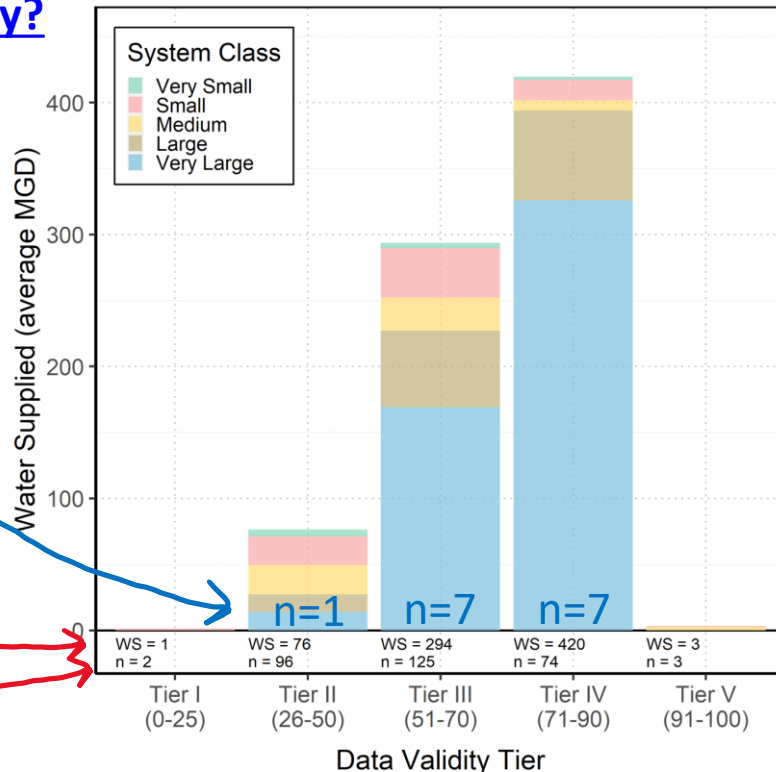
Number of Very Large systems

Corresponding volume of water supplier

The number of systems in that tier

Why improve data validity?

1. Higher data validity helps refine estimates of water loss, reducing uncertainty and improving models and sustainability planning.

2. More reliable data can result in more reliable insight on progress

3. Individual utilities can improve operational practices to increase scores, likely also improving system performance.

4. Set the foundation to help improve understanding of realistic expectations

5. **It's just good science.**

PRISON ESCAPE PLAN

Number of sheets to repel wall:	n g 9	12 sheets
Time to cross prison yard:	n g 10	30 seconds
Tunnel height:	n g 10	2 feet
Tunnel length:	n g 2	300 feet

"We're almost free, everyone! . . . I just felt the first drop of rain."

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What is Level 1 validation?

Level 1 Water Audit Validation Guidance Manual
Second Edition

PROJECT NO. 5057
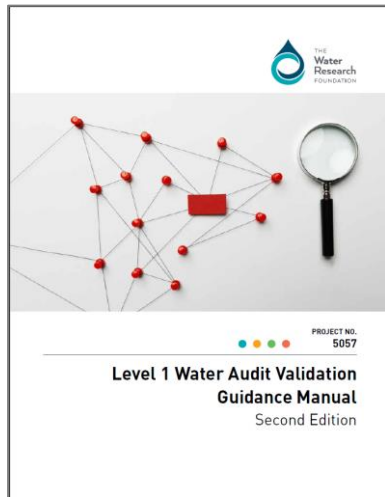
- Would catch things like "negative losses" and work to correct the errors

- Checks that reports are completed according to AWWA M36 standards

- Does not mean a report's validity increases – a report can have unreliable data (i.e. data scores of 2,3,4) but the validation process confirms that the data is unreliable.

Basically, a program to have a third-party reviewer check the audits to ensure it is accurate.

Does anyone have validation requirements / programs?

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

"Qualified Water Loss Auditor" (QWLA)
State cert program – pass state exam
https://epd.georgia.gov/watershed-protection-branch/water-efficiency-and-water-loss-audits

American Water Works Association
California-Nevada Section

"Water Audit Validator" (WAV)
Certification program via CA-NV AWWA & consultant firms
https://ca-nv-awwa.org/canv/CNS/EventsandClasses/Edu/WAVCertification.aspx

IFA
Indiana Finance Authority

"Certified Validator"
Pass state exam, have CA-NV WAV cert., or GA-QWLA cert.
https://www.in.gov/ifa/water-loss-audits/

Requires validated audits, no "certified validator" program.
https://dlnr.hawaii.gov/cwrm/planning/conservation/

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Questions for consideration:

1. How could DRBC improve the data validity scores throughout the Basin?

2. What _can_ DRBC do, what _should_ DRBC do?

3. Would it include a data validation process?
   i. What would a program look like (i.e., mandatory/incentivized/none)
   ii. Would it require certified validators? (Basin program, what is the capacity of other programs to train)

4. What is the best way to go about starting something?
   i. Would it apply to all systems – or just cohorts (e.g. Very Large, Large, then others to follow)

5. What are the financial implications for systems?

6. Do we want to have someone come to the next WMAC meeting to discuss this

## **4. Perform analyses on the Economic Level of Leakage**

It is recommended that the feasibility of performing Economic Level of Leakage analyses for the Very Large systems within the Basin be investigated. These fifteen systems collectively account for about 80% of the possible real loss reductions according to the analysis using ILI frontiers. Understanding the economic restrictions would provide a more realistic estimate for the Delaware River Basin, as currently it is understood that the frontier ILI=1 represents a theoretical minimum, and not a realistic scenario for which to plan.

What is the ELL:
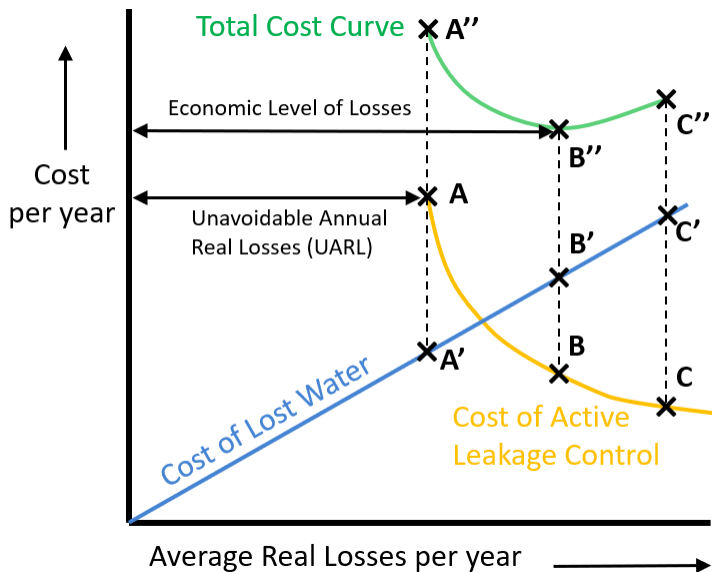
*Basic concept, with actual benefits extending beyond JUST the variable production cost of water

Why do this:
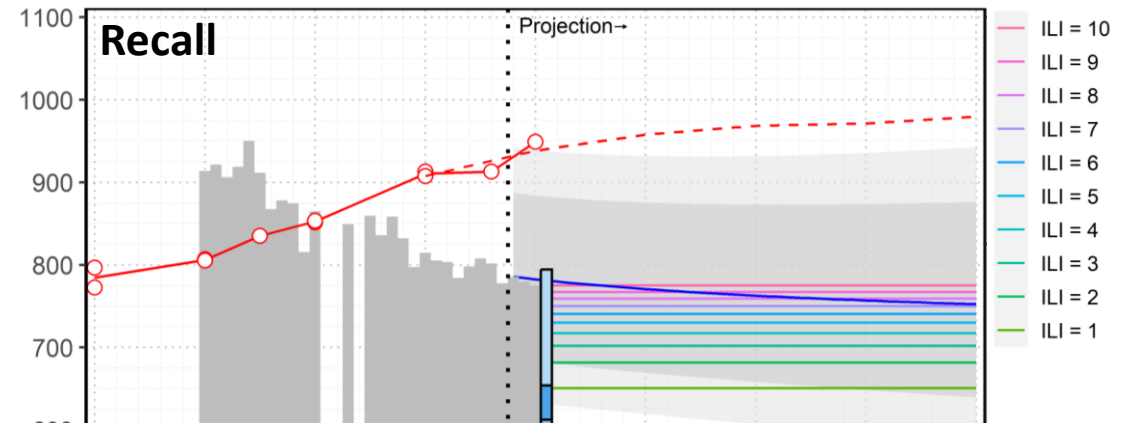
1. Its clear that all systems reaching ILI=1 is not realistic...

2. But what level of real loss reduction is realistic?

3. Expectations...

Lambert, A., Brown, T. G., Takizawa, M., & Weimer, D. (1999). A review of performance indicators for real losses from water supply systems. *Journal of Water Supply: Research and Technology—AQUA*, *48*(6), 227–237. https://doi.org/10.2166/aqua.1999.0025