Asset Management and Performance Indicators for Water Utilities

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US EPA Region 9 Environmental Finance Center (EFC)
Environmental Finance Center Network (EFCN)

California State Water Resources Control Board Training
March 2019

SACRAMENTO STATE
Office of Water Programs

ENVIRONMENTAL FINANCE CENTER
AT SACRAMENTO STATE

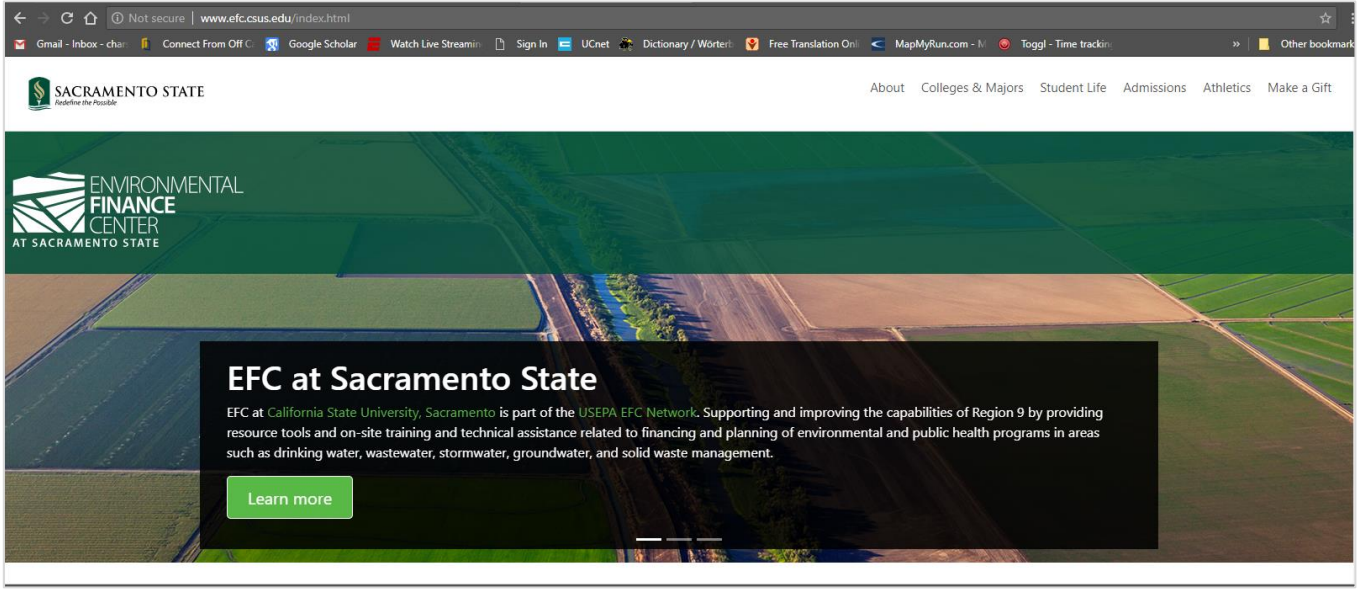
Environmental Finance Center Network (EFCN)

- Network of university-based centers across the U.S. building local capacity to address environmental management needs

https://efcnetwork.org

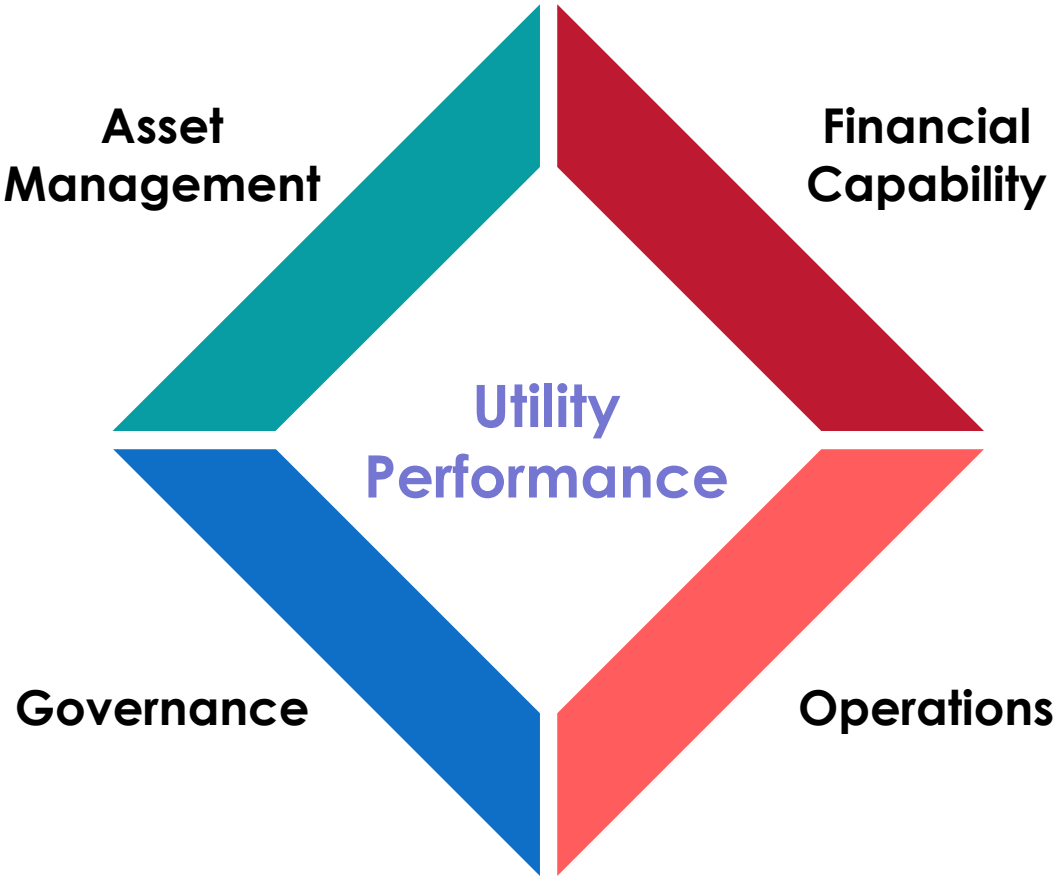
The EPA Region 9 EFC

- Providing expertise and tools for financing environmental and public health programs
  - Water system management and funding



California
Arizona
Nevada
Hawaii
Pacific Islands
Tribal Lands

Assessing Water Utility Performance



Indicators and Plans

- Some examples of indicators

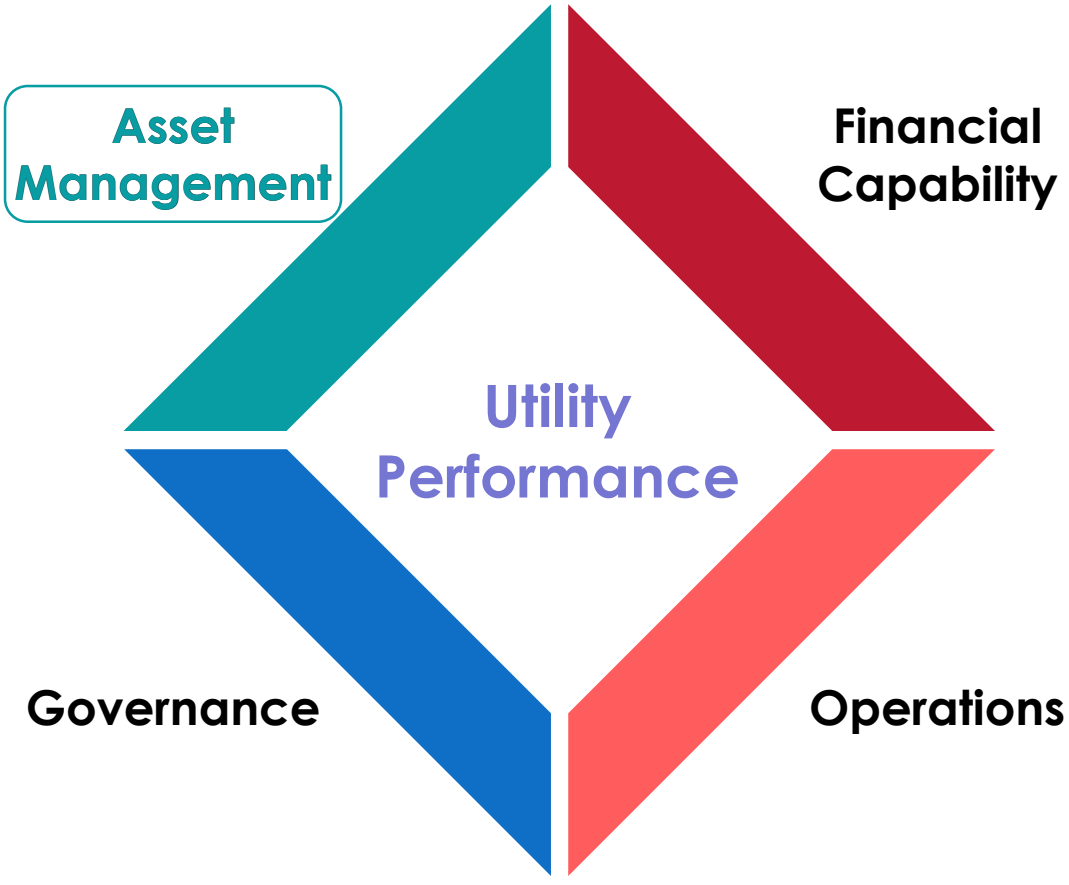
Operational:	Financial:
Average Daily Flow	Revenues-to-Expenses
Employee Labor Hours	Cash Reserves
Outages	Expenditures ($) per Customer

- Where to find information?
  - Asset management plans & inventories
  - Financial plans & reports
  - Capital improvement plans
  - Urban Water Management Plans

Audited financial statements

	2017	2016	2015
Current assets	$ 11,342,898	$ 10,431,354	$ 9,017,311
Other assets	395,869	49,874	49,874
Capital assets	36,734,853	35,726,924	35,615,871
Total assets	48,473,620	46,208,152	44,683,056
Deferred outflow of resources	840,843	598,001	138,018
Current liabilities	1,670,536	1,752,728	1,456,181
Non-current liabilities	2,578,513	2,140,138	1,512,684
Total liabilities	4,249,049	3,892,866	2,968,865
Deferred inflow of resources	307,902	320,998	268,663
Net Position:			
Investment in capital assets	36,734,853	35,726,924	35,615,871
Restricted	584,895	-	144,521
Unrestricted	7,437,764	6,865,365	5,823,154
Total net position	$ 44,757,512	$ 42,592,289	$ 41,583,546

Assessing Water Utility Performance



Asset Management

Asset Management for Water Systems

- A process for maintaining reliable system operations
  - Outlined through plans
- Identified need, especially in small systems

Includes technical, managerial, and financial aspects:

Evaluate system needs:
Infrastructure and management (O&M, permit compliance, future buildouts)

Evaluate financial needs:
Estimating costs and revenues (component costs, staff and labor, funding options)

Some Terms

- Asset Inventory: Detailed data on components of a system and condition

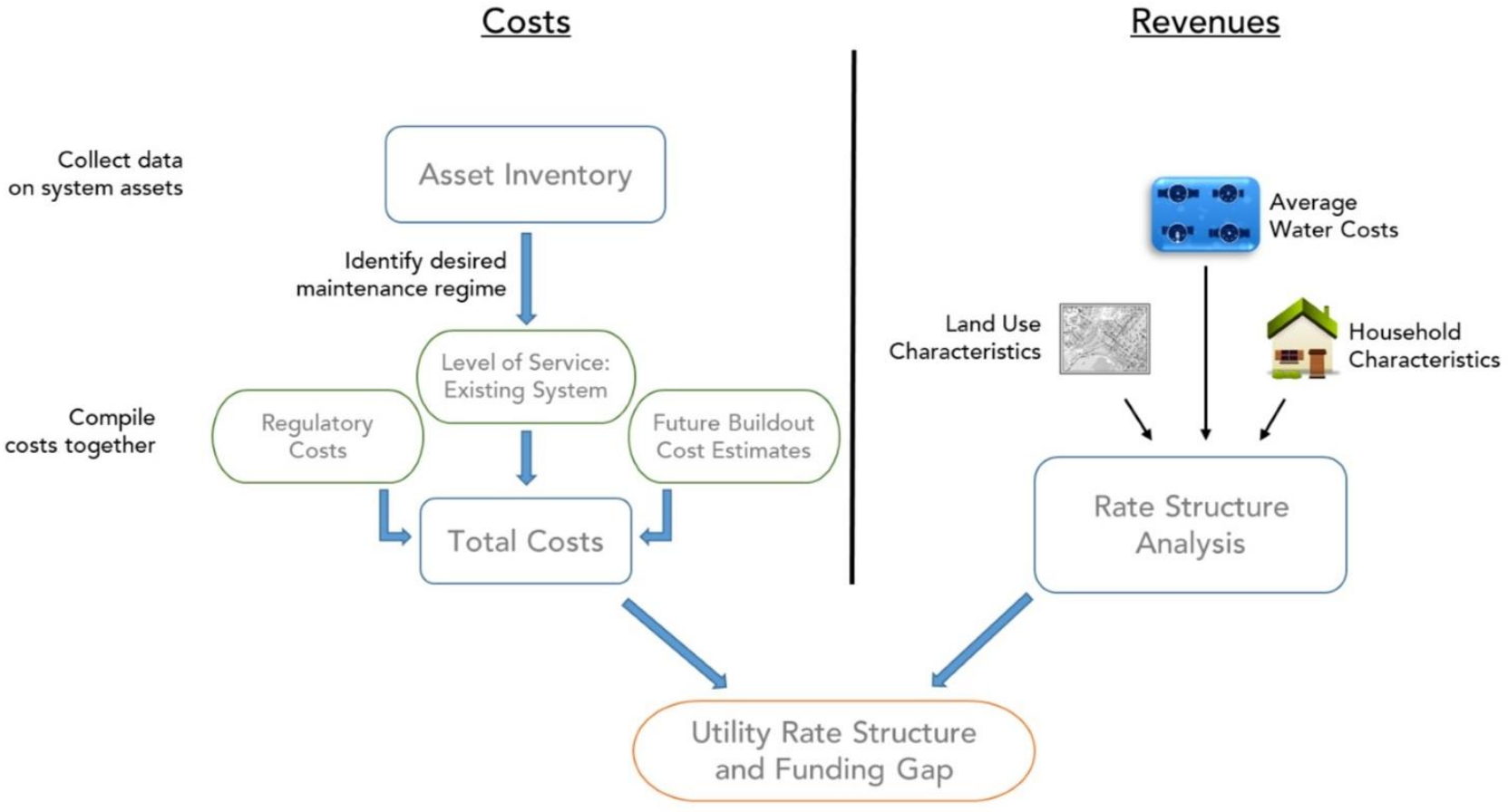


- Level of Service: Maintenance and replacement targets to provide a reliable system for residents

An asset inventory is key to asset management and financial planning

Photo Credits: pxhere.com, Wikipedia, pcryl.com

Assessing Costs, Revenues, and Funding



Collecting Data

Example of an **Asset Inventory** for a Water Treatment Plant

Process Unit	Number of Units	Approximate Date of Installation	Typical Lifespan (Years)	Remaining Life Span (as of 2011)	Approximate Replacement Cost or Original Cost (Unit Cost)	Total Cost	Current Replacement Cost/Remaining Life in Years
RAW WATER PUMPSTATION							
450gpm/25 hp Raw Water Intake Pump/Motor	2	1992	10 - 15	10	14,000	28,000	2,800
Raw Water Vacuum Pump	1	2000	3	1	1,500	1,500	1,500
Intake and Raw Water Line (600 feet of 10" PVC Pipe with concrete casing)	1	1992	35 - 45	15	45,000	45,000	3,000
Transmission Line from Pump Station to SWTP (~3,100 feet of 8" PVC C900 Pipe)	1	1992	35 - 40	20	22,500	22,500	1,125
SURFACE WATER TREATMENT PLANT							
Ozone System:							
Ozone Contactor Tower	1	1992	30 - 60	10	320,000	320,000	32,000
Ozone Generator (25 lbs/day)	2	1992	10 - 15	1	125,000	250,000	250,000
Air Compressor	2	1992	10 - 15	1	20,000	40,000	40,000
Air Dryer	2	1992	10 - 15	1	20,000	40,000	40,000
Ozone off-gas Destruction Unit	1	1992	10 - 15	1	35,000	35,000	35,000
Ozone alarm system	1	1992	5 - 10	2	52,000	52,000	26,000
Coagulant Feed System:							
Chemical Feed Pump (14.4 gal/day)	2	2005	5 - 10	3	3,500	7,000	2,333
Chemical Feed Day Tank	1	1992	10 - 15	10	15,000	15,000	1,500

Needed CIP/yr	**$**	**1,259,195**
Needed CIP/(mo*600 conn)	**$**	**175**

Note: This does not include inflation, pre-treatment addition, intertie to sewer, or additional storage.

Source: State Water Board

Prioritizing Investments

- No "right" way to prioritize investments

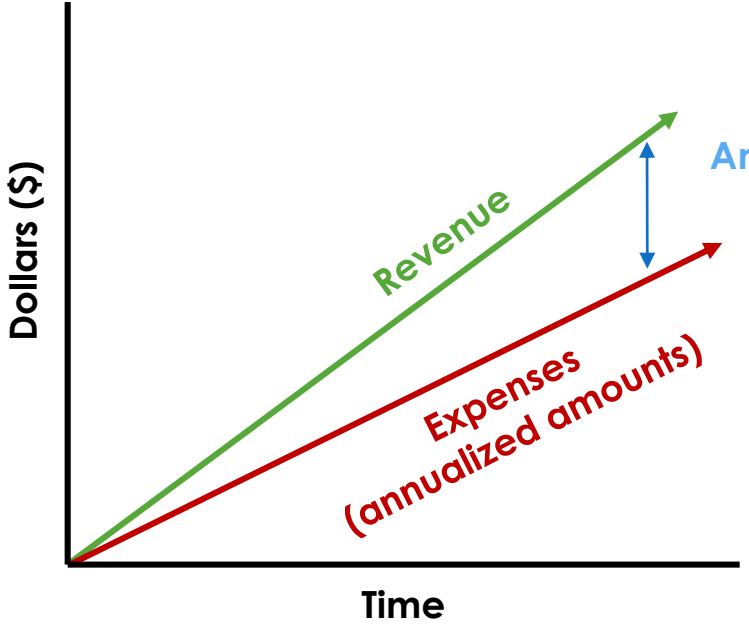
Many Potential Factors:

(source: EPA 2003)

1. Existing threat to public health, safety, or environment;
2. Potential public health, safety, or environmental concern;
3. Internal safety concern or public nuisance;
4. Improved system operations & maintenance (O&M) efficiency; and
5. It would be nice to have...

Why is Prioritization Important?

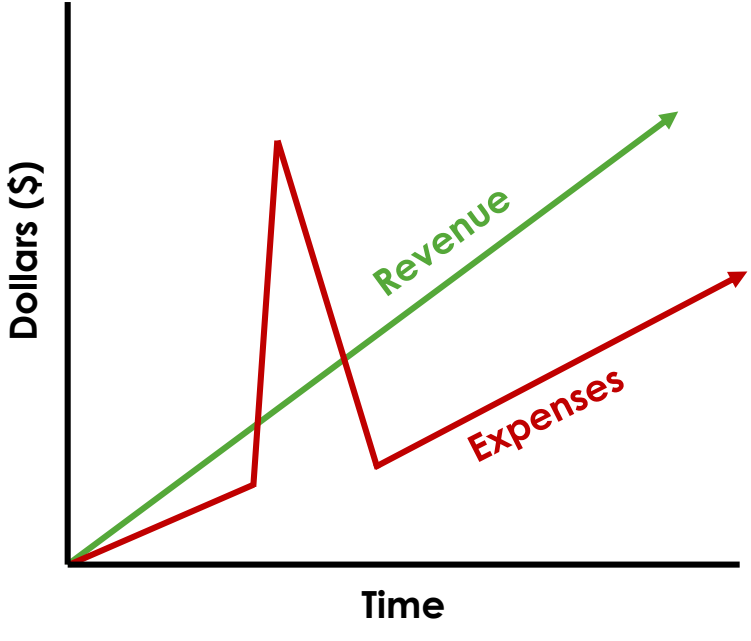
- Prioritizing assets helps mitigate failure risks



Amount of Surplus:
Available for Investments or Reserves

Why is Prioritization Important?

- Prioritizing helps mitigate risk of failure



Big Equipment Failure

Need Reserves!

Prioritizing Based on Failure Risk

- Probability of Failure (POF): likelihood of an asset failing
- Consequence of Failure (COF): effects of an asset failing

Asset 1: Pumps in station

Asset 2: Concrete pipe

Asset 3: Recycled water pump

Asset	Effective Life	Structural Condition	POF	COF	Rank
Pumps in station	30 years	Excellent	Low	High	Medium
Concrete water pipe	100 years	Poor	High	Medium	High
Recycled water pump	20 years	Good	Medium	Low	Low

Image Sources: NRCS, Flickr, Wikipedia

Ranking Assets

- Prioritize investments based on criteria

Water Treatment Plant: Reordered List

Process Unit	Number of Units	Approximate Date of Installation	Typical Lifespan (Years)	Remaining Life Span (as of 2011)	Approximate Replacement Cost or Original Cost (Unit Cost)	Total Cost	Current Replacement Cost/Remaining Life in Years	POF	COF	Rank
RAW WATER PUMPSTATION										
Transmission Line from Pump Station to SWTP (~3,100 feet of 8" PVC C900 Pipe)	1	1992	35 - 40	20	22,500	22,500	1,125	8	9	9
Raw Water Vacuum Pump	1	2000	3	1	1,500	1,500	1,500	9	5	7
Intake and Raw Water Line (600 feet of 10" PVC Pipe with concrete casing)	1	1992	35 - 45	15	45,000	45,000	3,000	4	9	7
450gpm/25 hp Raw Water Intake Pump/Motor	2	1992	10 - 15	10	14,000	28,000	2,800	3	9	6

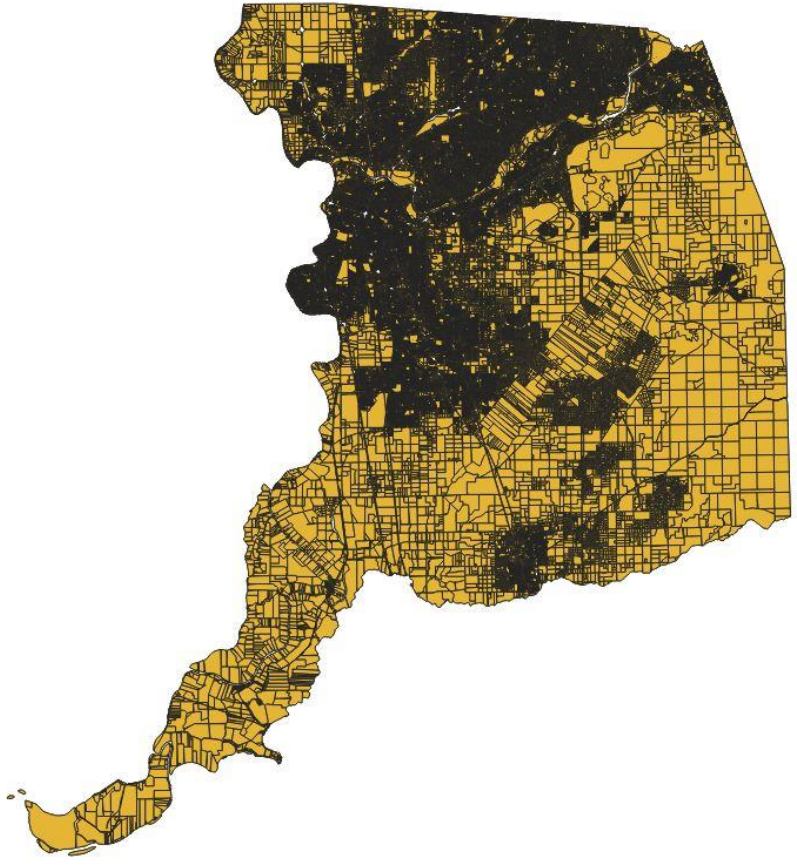
Invest in This Asset First

Tools and Data for Asset Management

Collecting and Storing Data

- Paper
- Spreadsheets
- GIS and Google Earth
- Online databases

Mapping water pipes and properties



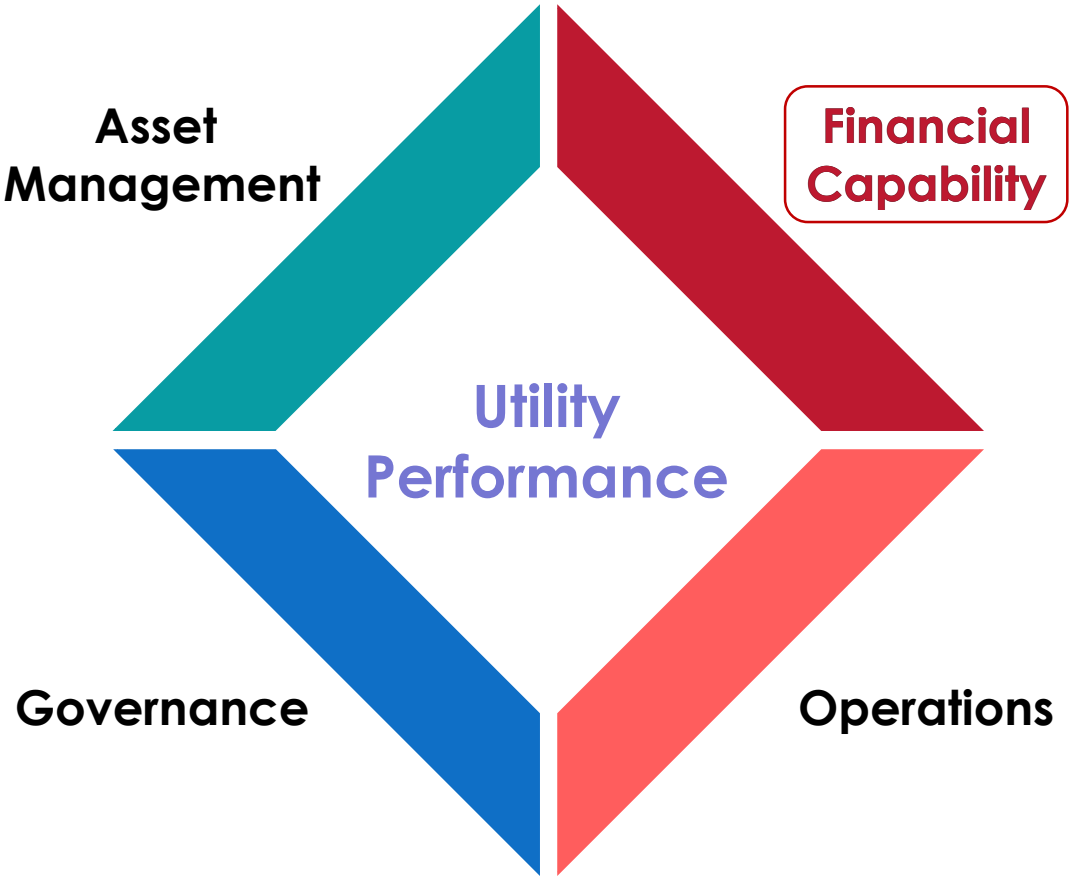
Source: EFC at Sac State

Asset Management Tools

- Paper
- Spreadsheets
- Commercial software
- Free software

EPA's Check-Up Program for Small Systems (CUPSS) & Mobile Assistant

Assessing Water Utility Performance

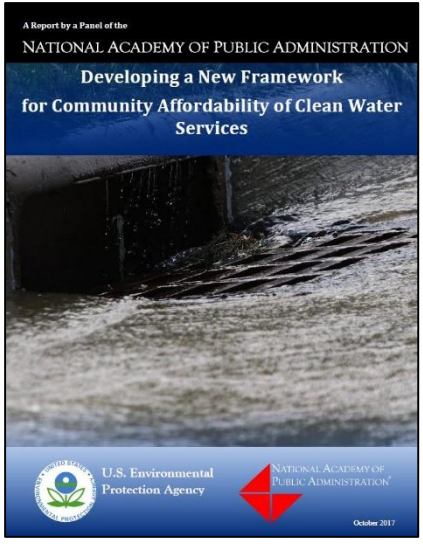


Financial Capability

Financial Capability

- Utilities: Is a utility maintaining sufficient funds to operate and renew systems?

- Customers: Can utility customers afford to pay current bills and future upgrades?



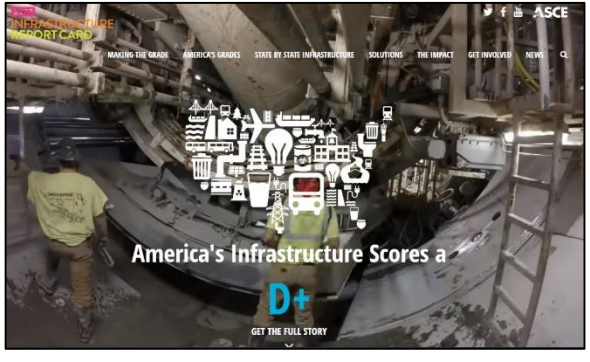


Photo Credits: ASCE, infrastructurereportcard.com

Financial Capability Benchmarks

- Assessing **financial capability** includes both utilities and communities

Utility: Capacity for maintaining reliability and managing funds

Possible indicators:
Bond ratings
Debt
Revenues and Expenses

Community: Ability to pay current and future rates required to maintain system

Possible indicators:
Unemployment rates
Median household income & household spending
Collection rates (property taxes or utility bills)

What are the best indicators for small systems?

Source: NAPA & USEPA 2017, "Developing a New Framework for Community Affordability of Clean Water Services"

Some Simple Financial Indicators

Concepts:	Indicators:
Expenses	Operating ratio
Revenues	Rate analysis
Debt	Debt service coverage ratio
Assets	Annualized costs
Maintenance & renewal	Reserves

Covering Costs

- **Operating ratio** (revenues-to-expenses)
  - Provides a snapshot of ability to pay for operations

$$\textbf{Operating Ratio} = \frac{\text{Operating Revenues}}{\text{Operating Expenses}}$$

  - Can be adjusted to account for long-term system needs

Existing System Conditions

- **Annual Replacement Costs**, allocated over remaining life

Process Unit	Number of Units	Approximate Date of Installation	Typical Lifespan (Years)	Remaining Life Span (as of 2011)	Approximate Replacement Cost or Original Cost (Unit Cost)	Total Cost	Current Replacement Cost/Remaining Life in Years
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Note: This does not include inflation, pre-treatment addition, intertie to sewer, or additional storage.

Source: State Water Board

Existing System Conditions

- **Depreciation** is accrued reduction in value of assets over time
  - Helps measure extent of deferred O&M, and expenses

$$\textbf{Adjusted Operating Ratio} = \frac{\text{Operating Revenues}}{(\text{Operating Expenses} + \text{Depreciation})}$$

Rates and Revenues

- **Analyzing rates** helps understand the costs and revenues for a utility
  - Rate structures
  - Expenditures per unit of operations
    - $/linear mile of pipe
    - $/customer
    - $/fixture
    - $/connection

Table 3.25 Operation and maintenance costs

Agency	Population Served	Length of Gravity Sewer, miles	Annual O&M Expense	O&M Cost per Capita	O&M Cost per Mile of Gravity Sewer	Amount of O&M Budget Allocated for Contracted Services	Annual O&M Training Budget	Number of O&M Personnel	Annual Training Cost per Person
A	10,444	44.5	$ 32,000	$ 3.35	$ 719	$ 78,400	$ 2,300	2	$1,150
B	40,000	114	340,000	8.50	2,982	2,000	1,700	6	283
C	75,560	400	8,700,000	9.26	21,750	10,000	325	12	27
D	88,250	348	439,000	4.97	1,261	21,000	3,064	20	153
E	150,000	500	16,206,178	108.04	32,412	NA	5,000	16	313
F	177,000	630	2,700,000	15.25	4,286	1,000,000	15,800	33	479
G	284,000	1,481	5,300,000	18.66	3,579	1,100,000	16,000	39	410
H	347,000	1,537	8,964,000	25.83	5,832	153,000	15,700	150	105
I	456,445	1,385	2,358,447	5.17	1,703	0	770	30	26
J	475,000	2,664	219,016,400	9.46	82,213	501,900	87,200	420	208
K	700,000	2,289	23,000,000	32.86	10,048	NA	100,000	235	426
L	737,877	2,946	9,700,000	13.15	3,293	290,000	8,800	174	51
M	950,000	2,543	145,803,513	62.90	57,335	NA	106,000	503	211

NA = Not Available

Survey Data of Sanitary Sewer Collection Systems Performance (Source: Collection Systems Evaluation Manual, OWP at Sac State)

Debt

- **Debt service** is the amount owed to pay back loans & bonds
- **Coverage ratio** measures ability to pay debt after operational expenses (debt to service ratio)

$$\textbf{Coverage Ratio} = \frac{(\text{Total Revenue} - \text{Non-Debt Expenses})}{\text{Debt Payments}}$$

Saving for that Rainy Day

- **Reserves** and **cash-on-hand**
  - Cash-on-hand can be in terms of total, days, or months

Example: Months of Cash on Hand

$$= \frac{\text{Unrestricted Cash}}{\text{Operational Costs per Month}}$$

"Unrestricted cash" can be spent on any expense

Example:

Operating Ratio

Rates Analysis

Debt Service Coverage Ratio

An Example: Hill Valley, CA

1885: Small water system

1955: Growing suburbs

1985: Built out city

2015: Futuristic solutions

Credit: Flickr, alanboar

Finding Information

- Annual reports
- Financial statements
- Accounting records

Condensed Statement of Revenues, Expenses, and Changes in Net Position
(In thousands)

	2017	2016
Revenues		
Operating revenues	$ 44,200	$ 41,100
Rental	$ 300	$ 300
Interest and investments	$ 500	$ 600
Grants	$ 400	$ 800
Other	$ 200	$ -
Total revenues	$ 45,500	$ 42,700

Condensed Statement of Net Position

Assets	2017	2016
Current assets	$ 11,100	$ 7,900
Non-current assets	39,900	38,200
Capital assets, net	290,300	286,700
Total assets	341,200	332,800
Deferred outflows	9,500	9,400
Liabilities		
Current liabilities	9,300	9,300
Non-current liabilities	94,900	98,500
Total liabilities	104,100	107,800
Deferred inflows	1,100	600
Net position		
Net investment in capital assets	207,200	199,500
Restricted for debt service fund	3,500	3,500
Unrestricted	34,700	30,800
Total net position	$ 245,400	$ 233,900

Covering Costs

$$\textbf{Operating Ratio} = \frac{\text{Operating Revenues}}{\text{Operating Expenses}}$$

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Other	$ 200	$ -
Total revenues	$ 45,500	$ 42,700
Expenses		
Operating expenses	$ 20,900	$ 19,800
Depreciation and amortization	$ 12,200	$ 11,800
Interest	$ 3,500	$ 3,600
Sub-recipient grant payments	$ 400	$ 800
other	$ -	$ -
Total expenses	$ 36,900	$ 36,000
Change in net position	$ 8,600	$ 6,700
Net Position- End of year	$ 242,500	$ 233,900

$$= \frac{\$44{,}200}{\$20{,}900} = 2.11$$

Add Depreciation:

$$= \frac{\$44{,}200}{\$20{,}900 + \$12{,}200} = 1.33$$

Analyzing Rates

Monthly Retail Water Rates

	2008	2009 To 2014	2015	2016	2017
Flat Accounts					
Usage Charge ($/1,000 per sq. foot)	$ 0.80	$ 0.91	$ 0.95	$ 0.98	$ 1.02
Flat Service Charge (single unit)					
¾" connection	15.12	14.89	15.49	16.11	16.75
1" connection	22.23	21.55	22.41	23.31	24.24
1 ½" connection	42.24	40.69	42.32	44.01	45.77
2" connection	45.04	40.19	41.80	43.47	45.21
Metered Accounts					
Usage Charge ($/100 cubic feet (CCF))					
Residential – 1st Tier (0-10 CCF)	0.73	0.80	0.83	0.87	0.90
Residential – 2nd Tier (11+ CCF)	0.91	1.00	1.04	1.08	1.12
Non-Resid–Off-Peak Rate (Nov-Apr)	0.75	0.81	0.84	0.88	0.91
Non-Resid.–Peak Rate (May-Oct)	0.94	1.01	1.05	1.09	1.14

Paying Debt

$$\textbf{Coverage Ratio} = \frac{(\text{Total Revenue} - \text{Non-Debt Expenses})}{\text{Debt Payments}}$$

Condensed Statement of Revenues, Expenses, and Changes in Net Position
(In thousands)

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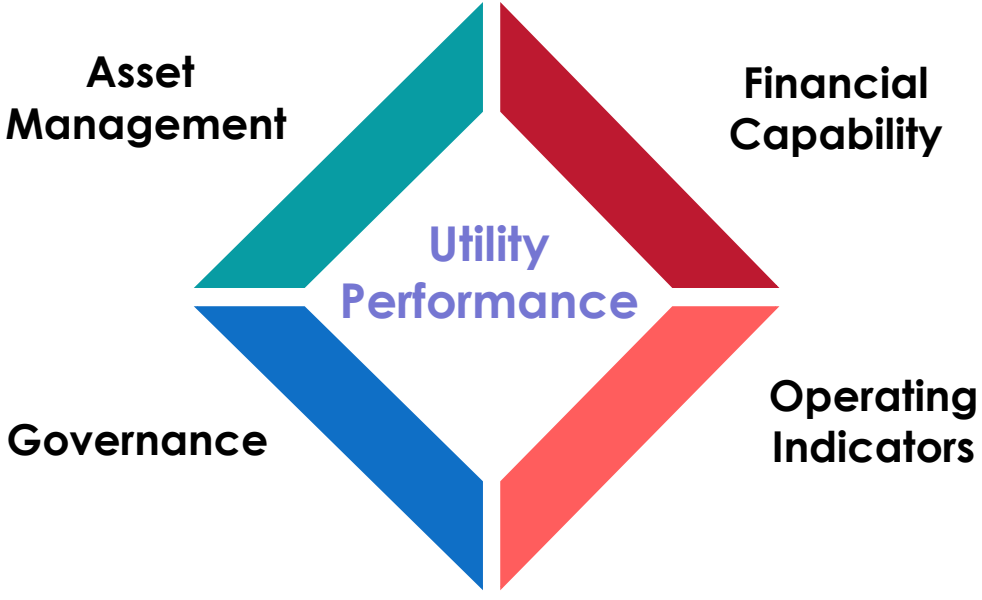
$$= \frac{(\$45{,}500 - \$20{,}900)}{\$3{,}500} = 7.03$$

Summary

- No single metric provides a complete estimate of water utility performance



- Need better public data for small and large systems in California

Some Resources

- EPA (2003), Learner's Guide "How to Conduct a Sanitary Survey of Small Water Systems"
- EPA (2004), "Taking Stock of Your Water System"

  https://www.epa.gov/sites/production/files/2015-04/documents/epa816k03002.pdf
- EPA (2003), Asset Management: A Handbook for Small Water Systems

  https://nepis.epa.gov/Exe/ZyPDF.cgi/2000261D.PDF?Dockey=2000261D.PDF
- New Mexico EFC (2006), "Asset Management: A Guide for Water and Wastewater Systems"

  https://www.env.nm.gov/dwb/assistance/documents/AssetManagementGuide.pdf
- ANSI/AWWA G410-09, "Business Practices for Operation and Management"
- RCAP (2011), "The Basics of Financial Management for Small-community Utilities"

  http://www.rcapsolutions.org/wp-content/uploads/2013/06/RCAP-Financial-Management-Guide.pdf
- RCAP (2011), "Formulate Great Rates"

  https://rcap.org/wp-content/uploads/2012/03/Formulate-Great-Rates.pdf

More Information

- Environmental Finance Center Network

  UNC: "Financial Benchmarking for Water Utilities":

  https://efc.sog.unc.edu/project/utility-financial-tools

  EFC-Network provides technical assistance
  https://efcnetwork.org

- Rural Community Assistance Corporation (RCAC)

  https://www.rcac.org

Links

EPA Region 9 Environmental Finance Center:
http://www.efc.csus.edu

Office of Water Programs at Sacramento State
https://www.owp.csus.edu
@waterprograms

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