

Public Health Guidance for Implementing Decentralized Non- Potable Water Systems

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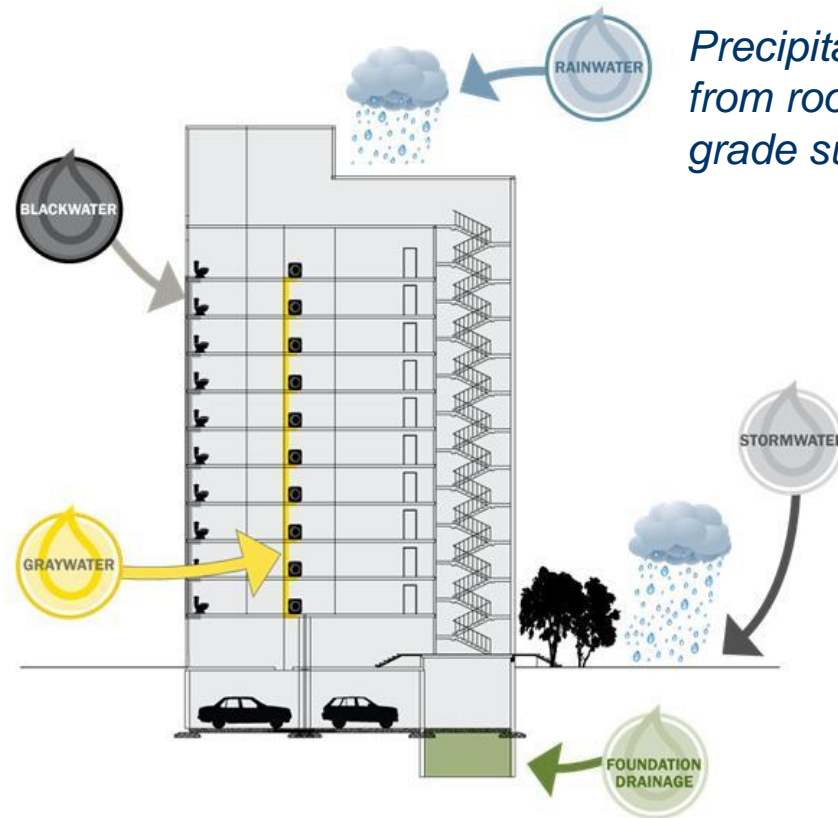
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Capturing Water for Non-potable Use

Wastewater from toilets, dishwashers, kitchen sinks, and utility sinks

Wastewater from clothes washers, bathtubs, showers, and bathroom sinks



Precipitation collected from roofs and above-grade surfaces

Precipitation collected at or below grade

Nuisance groundwater from dewatering operations

Decentralized Non-potable Water (DNW) Systems

A system in which water from local sources is collected, treated, and used for non-potable applications at the building to district/neighborhood scale generally at a location close to the point of generation.

Incorporating Onsite Water Systems at the SFPUC Headquarters



Solaire, New York



Permitted Since 2003
1000 residents
Recycles 25,000 gpd



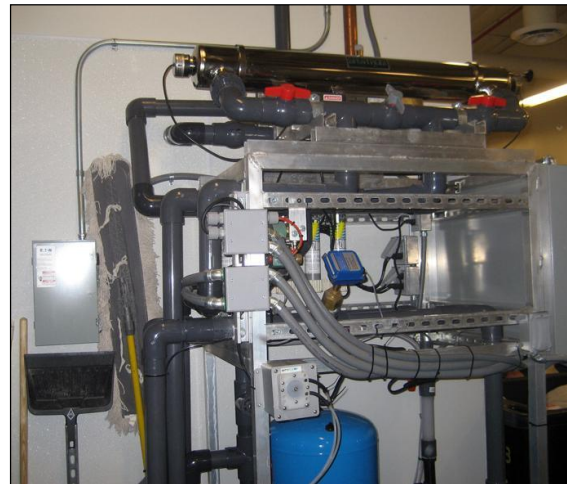
Source: American Water

Eloy Correctional Facilities Complex, Shower Water Recycling

- ***Permit issued:*** 2008
- ***Design flow:*** 225,000 gpd
- ***Source:*** Showers for 6492 beds are treated to Class A standard & reused for toilet flushing
- ***Saves 20 gpd/prisoner of potable water***



**Four facilities,
8178 beds total**

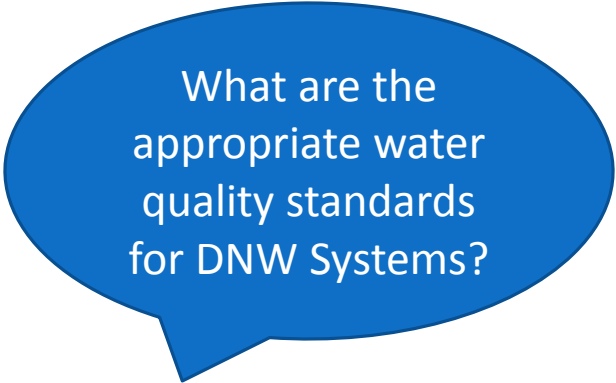


**Recycling
equipment,
Valentine
Engineering**

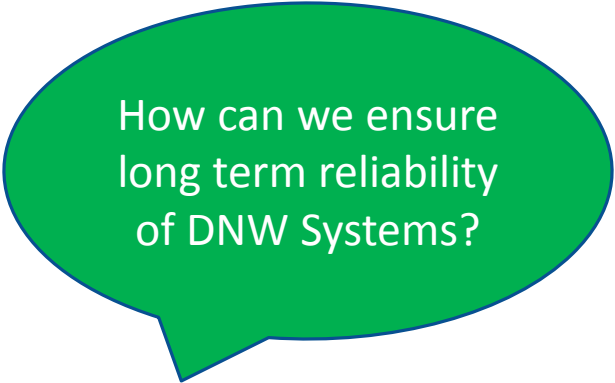
Embracing a OneWaterSF




Systems are Happening, But....



What are the appropriate water quality standards for DNW Systems?



How can we ensure long term reliability of DNW Systems?



How can ensure safe water is delivered at all times?

Water Quality:

Graywater Use to Flush Toilets

	BOD ₅ (mg L ⁻¹)	TSS (mg L ⁻¹)	Turbidity (NTU)	Total Coliform (cfu/ 100ml)	E. Coli (cfu/ 100ml)	Disinfection
California	10	10	2	2.2	2.2	0.5 – 2.5 mg/L residual chlorine
New Mexico	30	30	-	-	200	-
Oregon	10	10	-	-	2.2	-
Georgia	-	-	10	500	100	-
Texas	-	-	-	-	20	-
Massachusetts	10	5	2	-	14	-
Wisconsin	200	5	-	-	-	0.1 – 4 mg L ⁻¹ residual chlorine
Colorado	10	10	2	-	2.2	0.5 – 2.5 mg/L residual chlorine
Typical Graywater	80 - 380	54 -280	28-1340	10 ^{7.2} –10 ^{8.8}	10 ^{5.4} –10 ^{7.2}	N/A

Where we are now with DNWS....

State health departments and regulatory agencies need guidance on appropriate water quality standards

Current water quality standards are not risk based

Everyone has been looking to others for development of standards

Guidance on requirements for ensure reliability is needed

..... A risk based approach that is practical for implementation is needed



NWRI Panel formed

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Edward Clerico, P.E.

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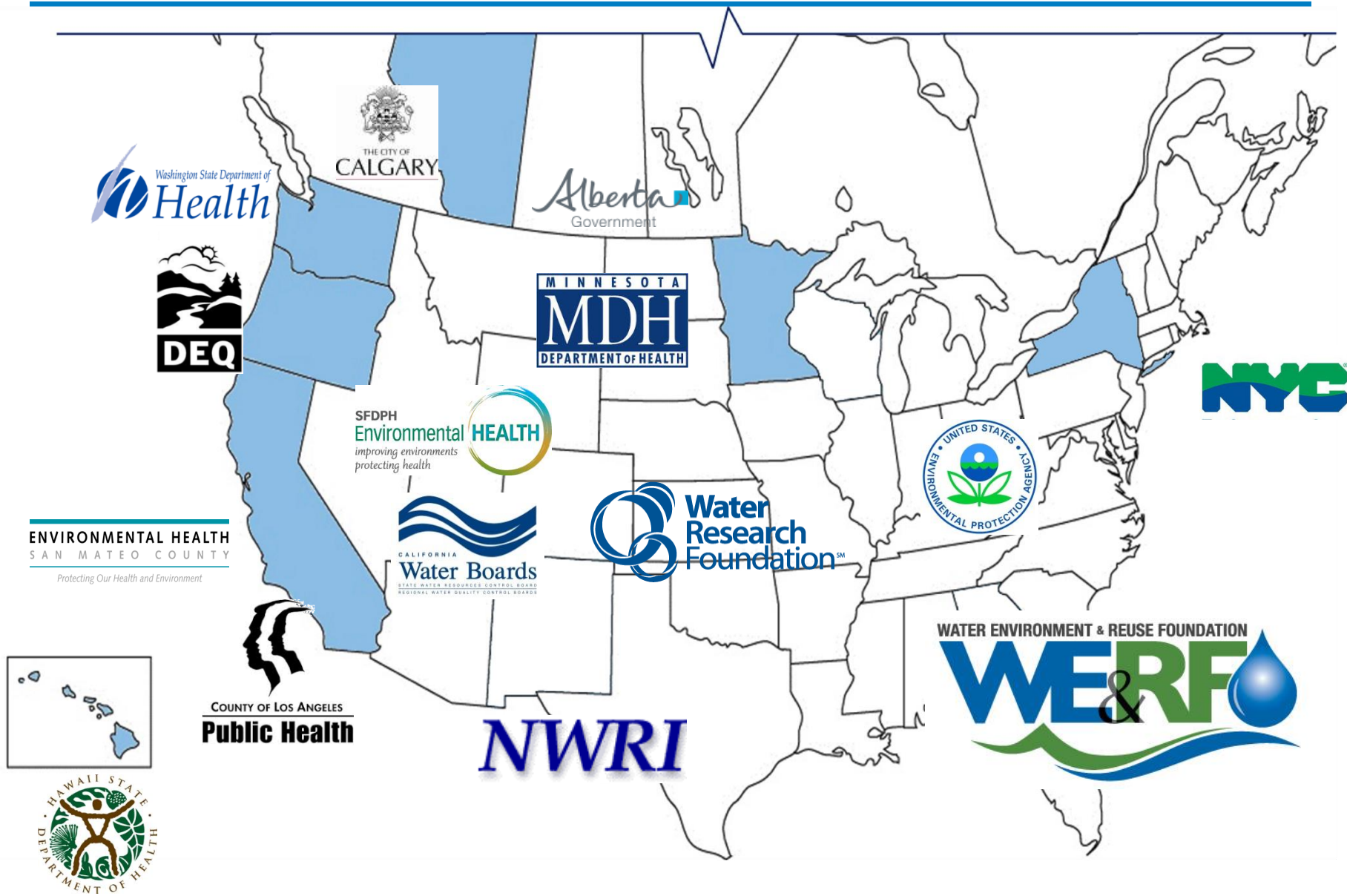
Harold Leverenz, Ph.D.

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Partnering to Develop Risk-Based Public Health Guidance



Stakeholder Engagement



Arizona Department of Environmental Quality
Austin Water Utility
California State Water Resources Control Board, Division of Drinking Water
City of Santa Monica, Office of Sustainability and the Environment
Colorado Department of Public Health and Environment
County of Los Angeles Public Health
Denver Water
DC Water
District of Columbia Department of Energy and Environment
Hawaii State Department of Public Health
Los Angeles Department of Water and Power
Minnesota Department of Health
New York City Department of Environmental Protection
Portland Water Bureau
Province of Alberta Municipal Affairs, Safety Services
San Francisco Department of Public Health
San Francisco Public Utilities Commission
Santa Monica Public Works
Seattle Public Utilities
United States Environmental Protection Agency, Office of Research and Development
Washington State Department of Health

Purpose of this Framework

Provide additional information and guidance to state and local health departments that allows these agencies to consider development of a DNWS program that adequately protects public health

Developed to address non-single residence applications (multi-user buildings and district/neighborhood scale)

Source waters

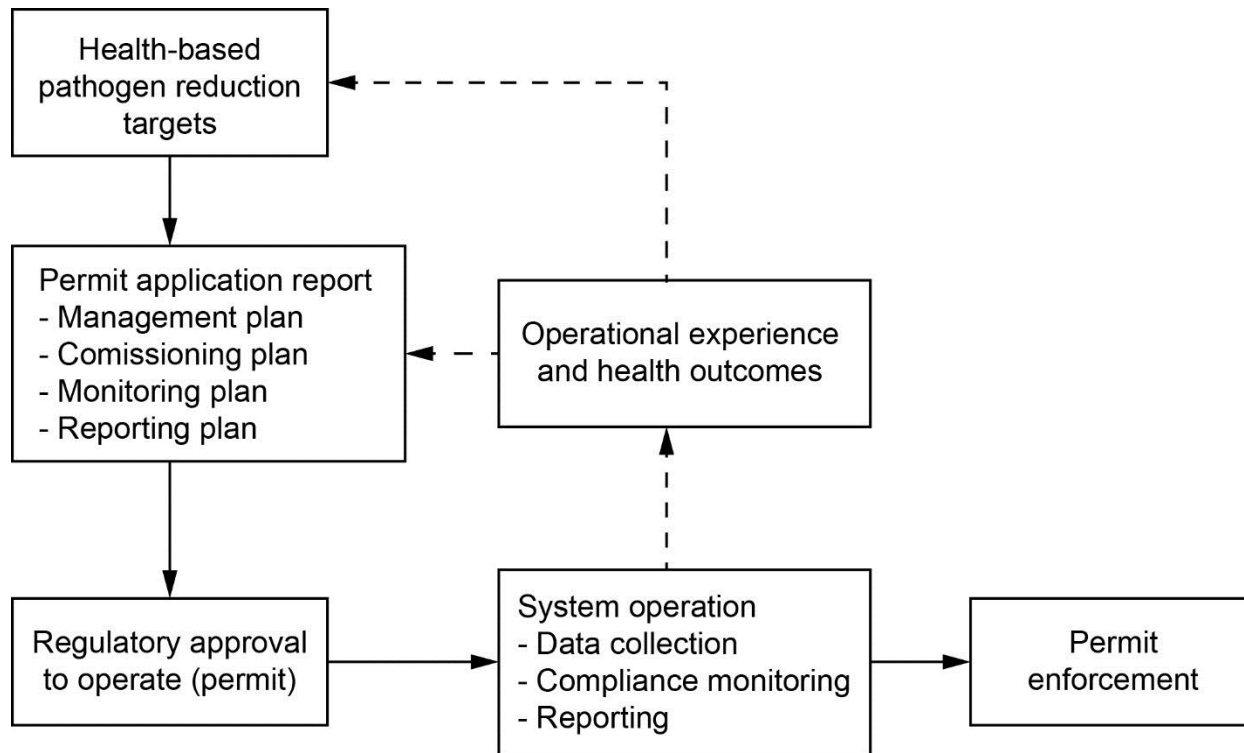
- Blackwater
- Graywater
- Domestic wastewater
- Roof runoff
- Stormwater
- Condensate
- Foundation water

Nonpotable end uses

- Toilet flushing
- Clothes washing
- Cooling tower
- Unrestricted-access municipal irrigation

Framework for DNWS

(Based on WHO Water Safety Plan)



Process for DNWS

Design

- Select appropriate log reduction target (LRT) for end use
- Select appropriate treatment process train to achieve LRT
- Professional Engineer approved

Management Plan

- Specify Responsible Management Entity (RME) Level (1-3)
- Designate RME Roles and Responsibilities

Permit Application Report Submission

- Specifies design, RME, assurance of reliability, commissioning plan, O&M plan, and plan for distribution system management
- Signed off by Registered Professional Engineer and approved by regulatory agency

Construction and Commissioning

- Field verification when required
- Submission of Commissioning Report (field verification results and final monitoring plan)

Operational Monitoring

- Continuous monitoring at high frequency for surrogate water quality and/or operational parameters correlated to LRTs
- Controls for out of compliance

Reporting

- Violations and incidents
- Routine reporting via format that is simple to review
- Approval and enforcement by regulatory agency

Risk Based Management Considerations

Management category		
1	2	3
Low	Risk characterization	High
Few users, no public access	Pathogen risk	Many users, public access
Simple devices and/or processes	Process malfunction risk	Complex devices and/or processes
Regulatory oversight		
System owner is fully responsible and accepts all liability for system performance. Local regulatory authority may provide owner education and registration of system as per their specific regulations.	System owner retains system responsibility and complies with local regulatory authority's additional quality control via a combination of manufacturer approval/certification, O&M manual, installation inspection, system permit and some degree of performance monitoring.	Prequalified RME accepts all performance responsibility. Regulator qualifies the RME, issues permit, reviews performance report and certifications, performs periodic inspections and enforces permit compliance.
RME requirements		
Private owner serves as RME and complies with regulatory authority's requirements.	Private owner as RME fully complies with local regulatory authority's requirements.	RME provides financial security, assumes full performance accountability, responsibility for permit compliance, routine reporting and certification.

Log₁₀ Pathogen Reduction Targets

Water Use Scenario	Log Reduction Targets for 10 ⁻⁴ (10 ⁻²) ppy Benchmarks		
	Enteric viruses	Parasitic protozoa	Enteric bacteria
<i>Municipal Wastewater</i>			
Unrestricted irrigation	6.0 (4.0)	6.5 (4.5)	5.0 (3.0)
Indoor use	6.5 (4.5)	7.5 (5.5)	6.0 (4.0)
<i>Graywater</i>			
Unrestricted irrigation	5.5 (3.5)	4.5 (2.5)	3.5 (1.5)
Indoor use	6.0 (4.0)	4.5 (2.5)	3.5 (1.5)
<i>Stormwater – 10⁻¹ dilution</i>			
Unrestricted irrigation	5.0 (3.0)	5.5 (3.5)	4.0 (2.0)
Indoor use	5.5 (3.5)	6.5 (4.5)	5.0 (3.0)
<i>Stormwater – 10⁻³ dilution</i>			
Unrestricted irrigation	3.0 (1.0)	3.5 (1.5)	2.0 (0.0)
Indoor use	3.5 (1.5)	4.5 (2.5)	3.0 (1.0)
<i>Roof runoff water</i>			
Unrestricted irrigation	Not applicable	No data	3.5 (1.5)
Indoor use	Not applicable	No data	3.5 (1.5)

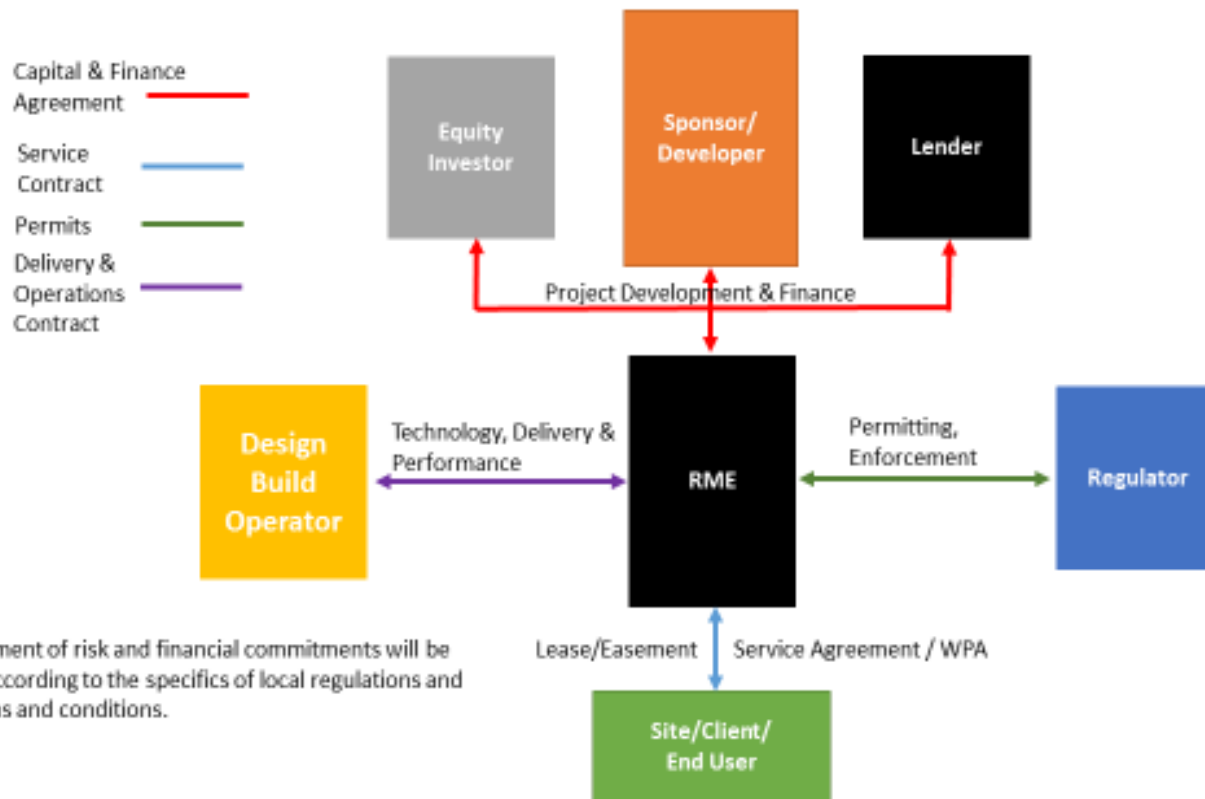
Achieving Pathogen LRTs

Example log reduction values (LRVs) for Disinfectants

Disinfectant	Unit	Dose for corresponding LRV			
		1-log	2-log	3-log	4-log
Chlorine (free)	mg • min/L		1.5 – 1.8	2.2 – 2.6	3 – 3.5
Chloramine ^b	mg • min/L		370 - 400	550 - 600	750 – 800
Peracetic acid	mg • min/L	NA	NA	NA	NA
Ozone	mg • min/L		0.25 – 0.3	0.35 – 0.45	0.5 – 0.6
UV radiation ^c	mJ/cm ²	50 - 60	90-110	140 - 150	180 - 200
Advanced oxidation ^{d,e}	mJ/cm ²	10 - 20	50 - 60	70 - 80	110 - 130
Pasteurization (60°C)	s	140	280	420	560

Management

Roles and Responsibilities



Monitoring

Routine monitoring of indicator organisms does not provide real time information required for operation of DNWS

- Cost prohibitive

A new monitoring approach:

- Validation testing
- Start-up and Commissioning
 - Field verification monitoring
 - Performance target confirmation via challenge testing
- Continuous verification monitoring
 - Ongoing verification of system performance
 - Continuous observations
 - Surrogate parameters correlated with LRTs
- Controls for out of specification

Permitting and Reporting

1. Draft PAR submitted, including proposed uses and treatment (if this step is allowed by the jurisdiction's process and it is justified by the project complexity)
2. Final PAR submitted, including plans and specifications, a commissioning plan, and O&M plan
3. Facility Commissioning Report, including results from field verification, and a final monitoring plan, submitted
4. Project permit decision

Routine reporting: simple to review

Violations and incidents promptly reported

Summary

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Acknowledgments

WERF Project Number SIWM10C15

- San Francisco Public Utilities Commission
- Water Research Foundation
- WaterReuse Research Foundation

NWRI Panel Members

NWRI staff for administering and organizing the Panel's activities

Stakeholder Group

Public Health Coalition

- Los Angeles County Department of Public Health
- New York City Department of Environmental Protection
- San Francisco Department of Public Health
- Hawaii State Department of Public Health
- Oregon Department of Environmental Quality
- Minnesota Department of Health
- Washington State Department of Health



Thank you