

Welcome to Day 2!

**Onsite Water Reuse Summit:
Integration of Science, Policy, and Operation for
Safe and Effective Implementation**

April 11, 2024



Review today's agenda

Aligning Plumbing Codes and Standards Panel Discussion



National Blue Ribbon
Commission
for Onsite Non-potable
Water Systems



WATERREUSE

Review today's agenda

***Remarks from David M. Turk,
Deputy Secretary, U.S.
Department of Energy***



National Blue Ribbon
Commission
for Onsite Non-potable
Water Systems



Review today's agenda

Deploying Onsite Treatment Systems and Lessons Learned Part 2 – Learning from Designers and Operators



National Blue Ribbon
Commission
for Onsite Non-potable
Water Systems



Review today's agenda

Water Reuse in High Performance Buildings

Deploying Onsite Treatment Systems and Lessons Learned

 Biohabitats

Erin English, PE
Practice Leader

**Kendeda Building for
Innovative Sustainable Design**
Atlanta, GA

LIVING BUILDING CERTIFIED | AIA COTE TOP 10



Biohabitats

We apply the science of ecology to restoring ecosystems, conserving habitat, and regenerating the natural systems that sustain all life on Earth.

National consulting firm of 40 years;
20+ years experience in onsite reuse

Water + Ecology
consultant to AEC industry

Specialty in natural
treatment systems

Pioneered early building
onsite reuse systems

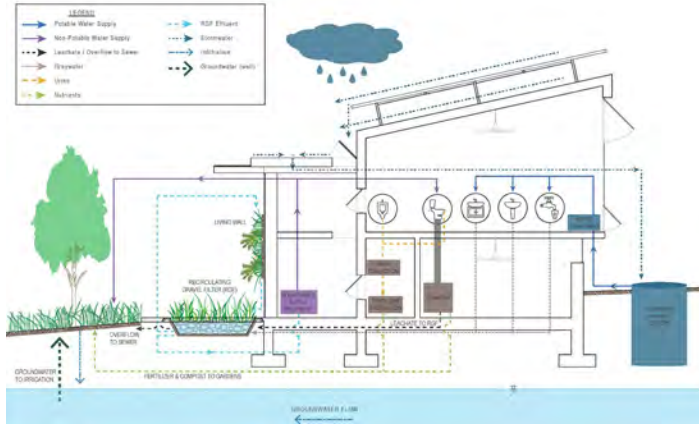


Just.

**ASLA FIRM
AWARD 2023**

Restore the Earth and Inspire Ecological Stewardship

TRENDS



WATER STRESS
133 FACILITIES
25% INCREASE NEXT 15 YEARS



WATER RESILIENCY INTEGRAL TO HIGH PERFORMANCE

Complements more mature net zero energy + decarbonization, healthy materials, wellness

INDUSTRY LEADERSHIP

Education
Environmental Institutions
Green Developers
Technology Firms

EMERGING GOVERNMENT ENGAGEMENT

OBO Water Resiliency R&D
National Gallery of Art
Constitution Gardens

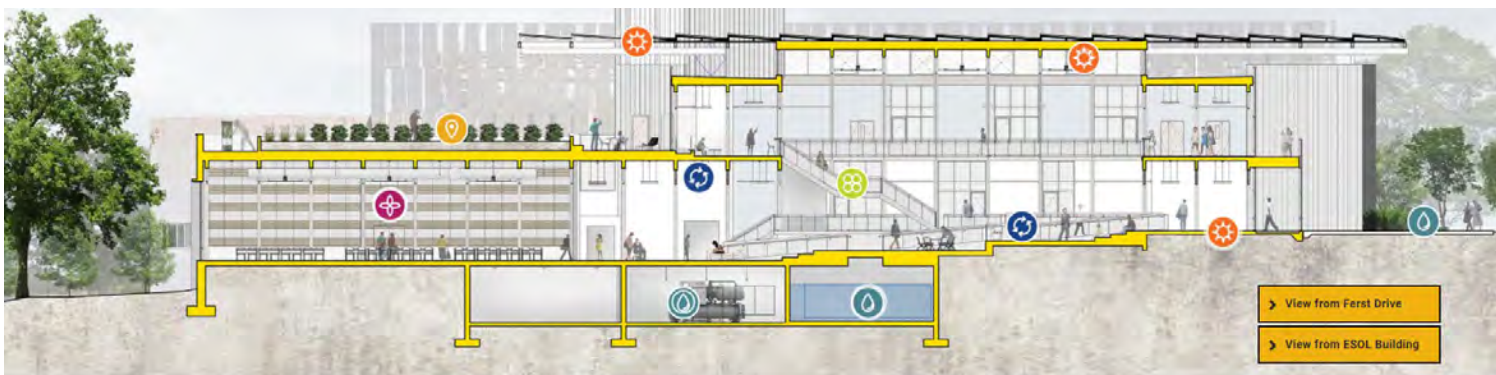
PROJECTS

KENDEDA LIVING BUILDING
Georgia Tech, Atlanta, GA

100% NET ZERO WATER

STRATEGIES

RAINWATER -> POTABLE
COMPOSTING TOILETS
GREYWATER TREATMENT
STORMWATER INFILTRATION



PLACE



WATER



ENERGY



HEALTH + HAPPINESS



MATERIALS

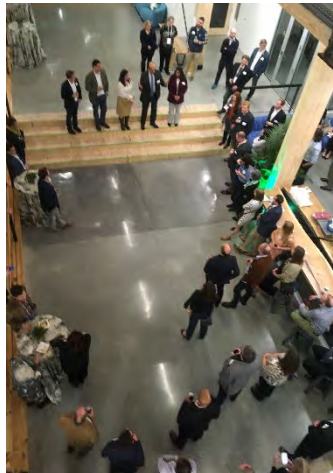


EQUITY



BEAUTY

The Bathrooms are a Main Attraction





PROJECTS

PAE LIVING BUILDING
Portland, OR

100% NET ZERO WATER

STRATEGIES

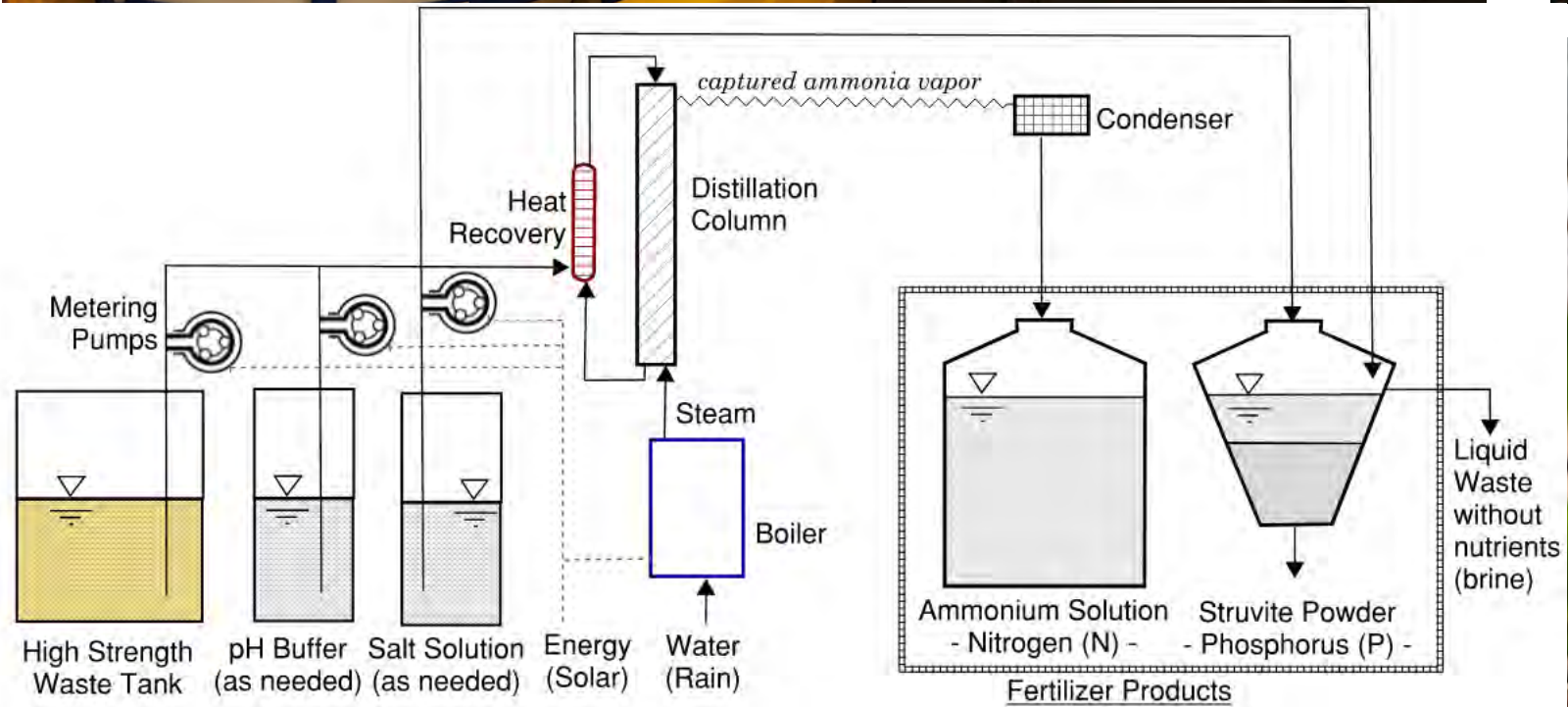
RAINWATER -> POTABLE

COMPOSTING TOILETS

GREYWATER -> NON-POTABLE

NUTRIENT RECOVERY





LEARNING

Cost – both first cost and ongoing O&M remain barriers to water reuse.

Permitting – Codes are evolving, complicating the consistent application and design;

Inspiration – Tangible, Connect people to water.

Universality–

Long way to go for more universal access, has equity implications.

Words of Caution - Using care to ensure that onsite systems are not a crutch for allowing continued overextraction of water, continuing the cycle of damage and degradation to the Ecosystems where we source our water from.



Is this project a significant **WIN** for
the health & abundance of water?

Is it Equitable?



Rio Grande Headwaters, CO
ERIN ENGLISH/BIOHABITATS

Learning From Designers and Operators: Interplay of Design and Permitting

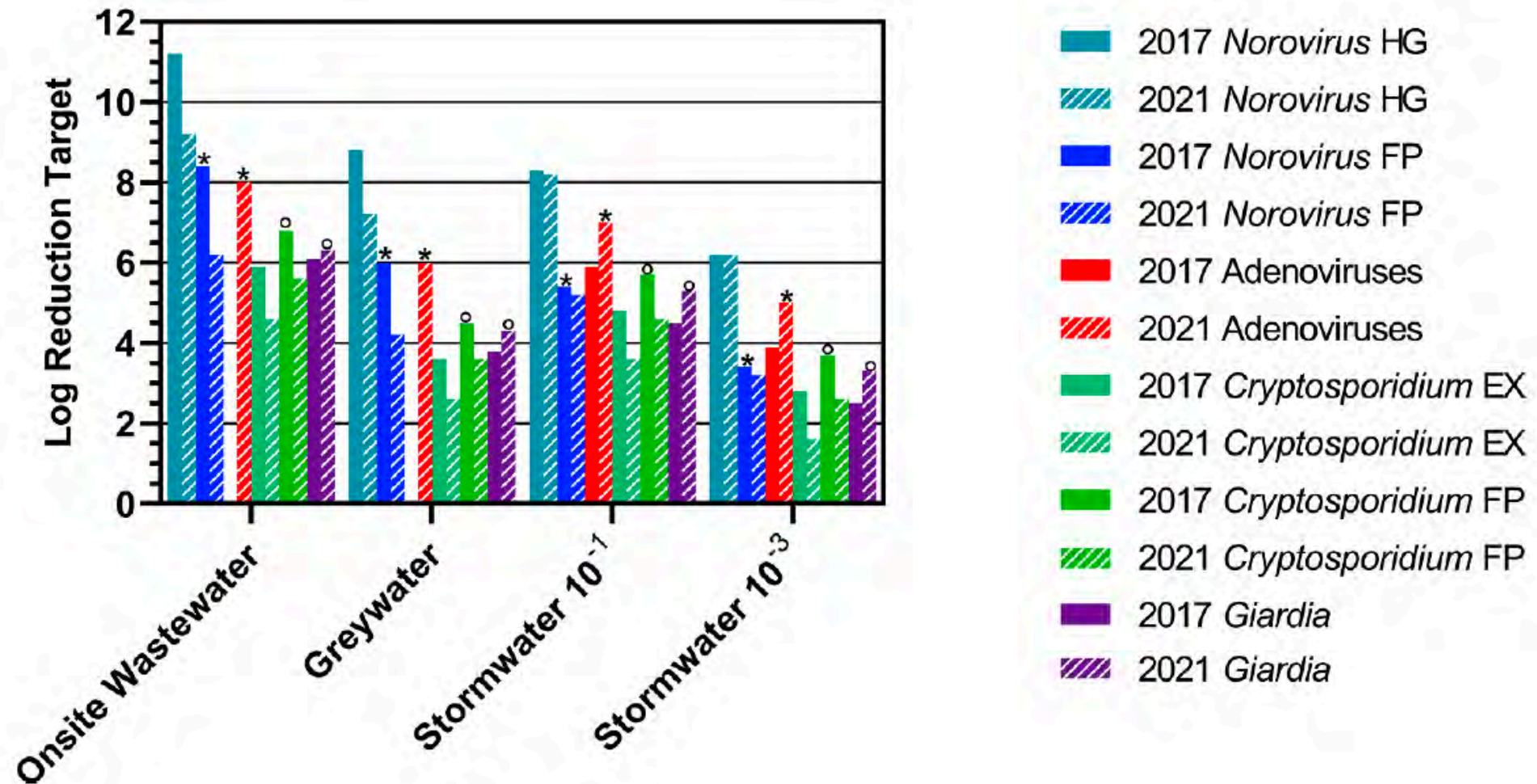


Brian Pecson, Ph.D., P.E.

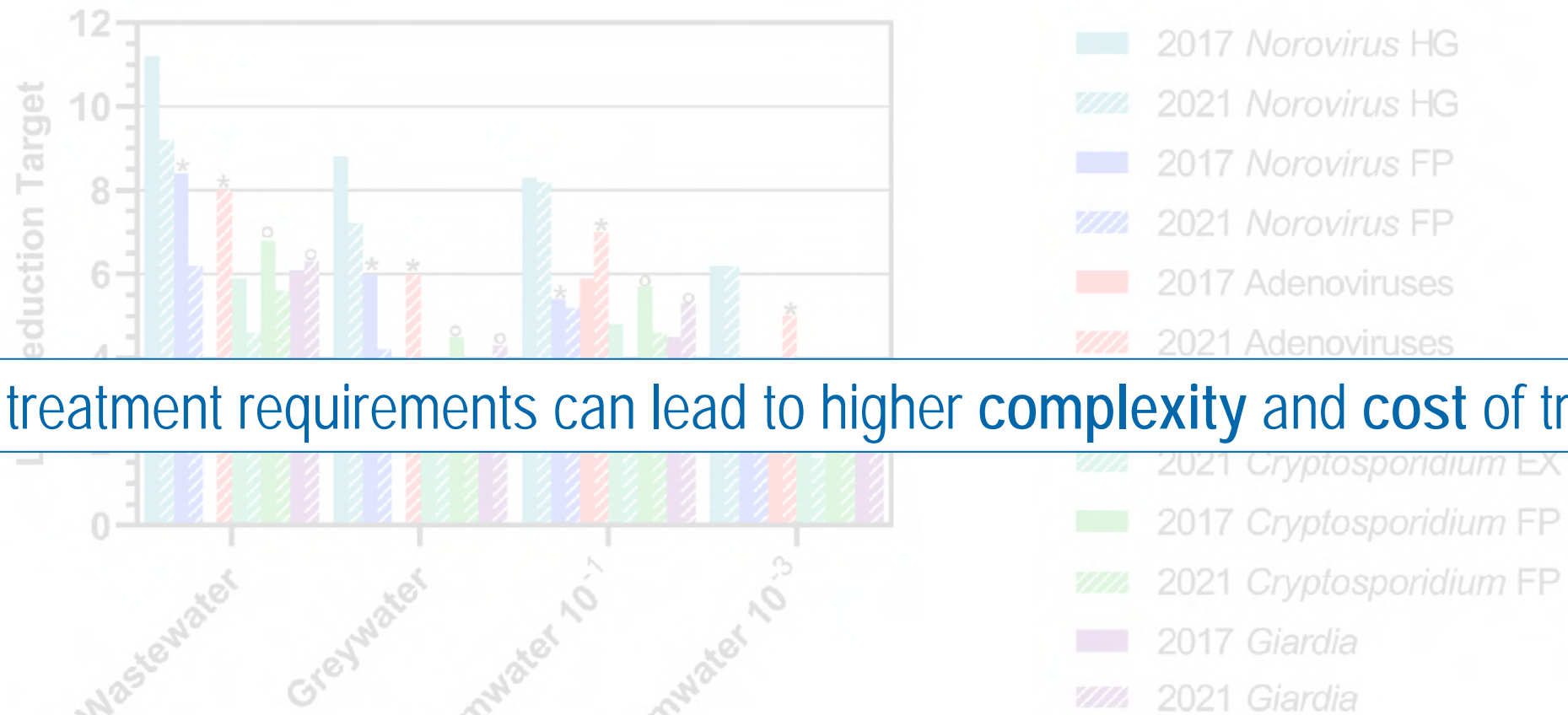
Anya Kaufmann, P.E.

Brie Post, P.E.

Pathogen treatment requirements are high!



Pathogen treatment requirements are high!



Higher treatment requirements can lead to higher **complexity** and **cost** of treatment

How can we minimize
the cost and complexity
of treatment design?





Impacts of permitting on ONWS design

- ONWS permits require demonstration of compliance with LRTs
- Crediting frameworks exist for some (but not all) unit processes
- **Consequence:** systems are not maximizing use of uncredited and under-credited unit processes
- **Solution:** designers should stay aware of emerging crediting frameworks to maximize value of their designs

MBR Crediting Example (WaterVal)

- MBRs had no crediting frameworks prior to 2017 → no pathogen credits for MBR
- WaterVal opened up MBR to receive credits...

Pathogen Credits

Pathogens	LRV
	MBR
Enteric Virus	1.5
Crypto	2.0
Giardia	2.0
Bacteria	4.0

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Monitoring and Design Requirements

Parameter	Operating envelope	
	Minimum	Maximum
Bioreactor pH	6	8
Bioreactor dissolved oxygen (mg/L)	1	7
Bioreactor temperature (°C)	16	30
Solids retention time (d)	11	–
Hydraulic retention time (h)*	6	–
Mixed liquor suspended solids (g/L)	3	–
Transmembrane pressure (kPa)	3	–
Flux (L/m ² /h)	–	30
Turbidity (nephelometric turbidity units)	–	0.2

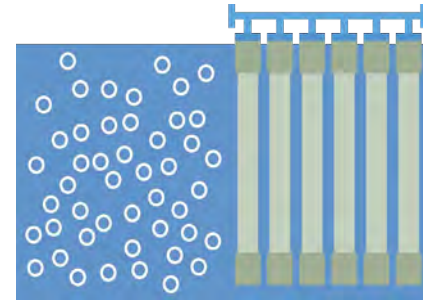
- ...but had onerous monitoring requirements

New MBR Crediting Simplifies Design & Operation

Pathogen Credits

Pathogens	LRV
	MBR
Enteric Virus	1.0
Crypto	2.5
Giardia	2.5
Bacteria	4.0

Monitoring Requirements



Requires online turbidimeter

- New crediting scheme (WRF 4997) reduces design and monitoring requirements
- Approach offers opportunity to reduce cost and complexity
- Accepted by California Division of Drinking Water for reuse projects

Free Chlorine Disinfection of Recycled Water

- Before 2017, CA regulators required site-specific testing for free chlorine credit
- WaterVal opened up free chlorine to receive credits in recycled water...

pH	Log ₁₀ inactivation	≤0.2 NTU					≤2 NTU					≤5 NTU				
		5 °C	10 °C	15 °C	20 °C	25 °C	5 °C	10 °C	15 °C	20 °C	25 °C	5 °C	10 °C	15 °C	20 °C	25 °C
≤7	1	4	3	2	2	1	4	3	2	2	1	4	3	2	2	1
	2	5	4	3	2	2	5	4	3	2	2	6	4	3	2	2
	3	7	5	4	3	2	7	5	4	3	2	7	5	4	3	2
	4	8	6	4	3	2	9	6	4	3	2	9	7	5	3	3

- ...but only defines a maximum credit of 4-log (*when 6-log is feasible!*)

Updated Free Chlorine Framework is Underway

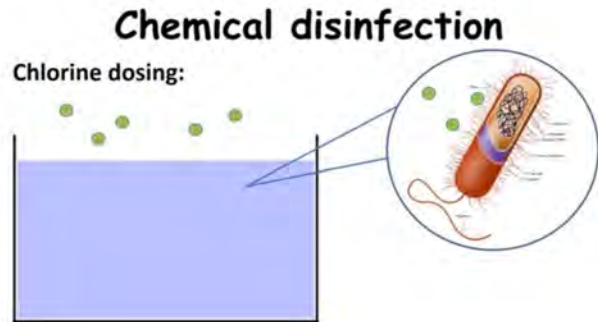
- California agencies working with regulators to expand virus credits (CalVal)
 - *Testing a wider range of water quality conditions for greater flexibility*
- New framework may allow systems to claim 6-log virus credit for free chlorine
- Other examples:
 - *EPA UV tables extended to 6-log (current)*
 - *Sub-residual ozone credit (ongoing)*
 - *Conventional activated sludge (ongoing)*
 - *Coagulation/flocculation sedimentation (ongoing)*



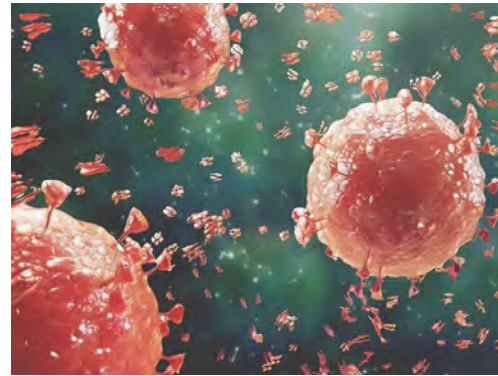
Pathway for Future Innovation

- WaterVal describes systematic 10-step method for validation

Identify Treatment Mechanism



Identify a Resistant Pathogen



Challenge Testing



Link Reduction to Online Surrogate



- Allows for continuous confirmation of process performance
- Approach used in California regulations for DPR and anticipated for ONWS

Summary

- Designers can optimize by staying up to date with advances in **permitting**
- Getting greater credit for unit processes can **reduce cost and complexity**
- New frameworks are expanding credits for under- and uncredited processes
- Systematic approach for validating new technologies is recommended

SHERWOOD DESIGN ENGINEERS

Full service civil and water resource engineering including analysis, planning, design, and construction services.

- Infrastructure Planning & Engineering
- Site & Buildings Planning & Engineering
- Water Resources Planning & Engineering
- Ecological Systems Planning & Engineering
- Sustainability & Resilience Planning
- Risk Analysis & Framework Planning



LESSON #1: COST OF MONITORING CHALLENGING FOR VIABILITY OF SMALL SYSTEMS

Costs associated with daily testing make it financially infeasible for smaller systems to pursue beneficial water reuse

- Daily coliform sampling can add thousands per year in operational costs, particularly in remote locations
- California is on the path to adopting a health risk-based approach with approved treatment trains (projected adoption Fall 2024)
- Presumably use of an approved treatment train will require less frequent sampling requirements
- Washington & Colorado adopting health risk-based approach

LESSON #2: SEWER MINING HAS CLEAR TECHNICAL MERITS, BUT CLEAR DELINEATION OF RESPONSIBILITIES AND RIGHTS NEEDED

Challenges with off-grid plant

- Large variations of influent flow require larger EQ tanks for peak flows
- Primary and secondary solids must be hauled away
- If operation is seasonal, annual startup is required

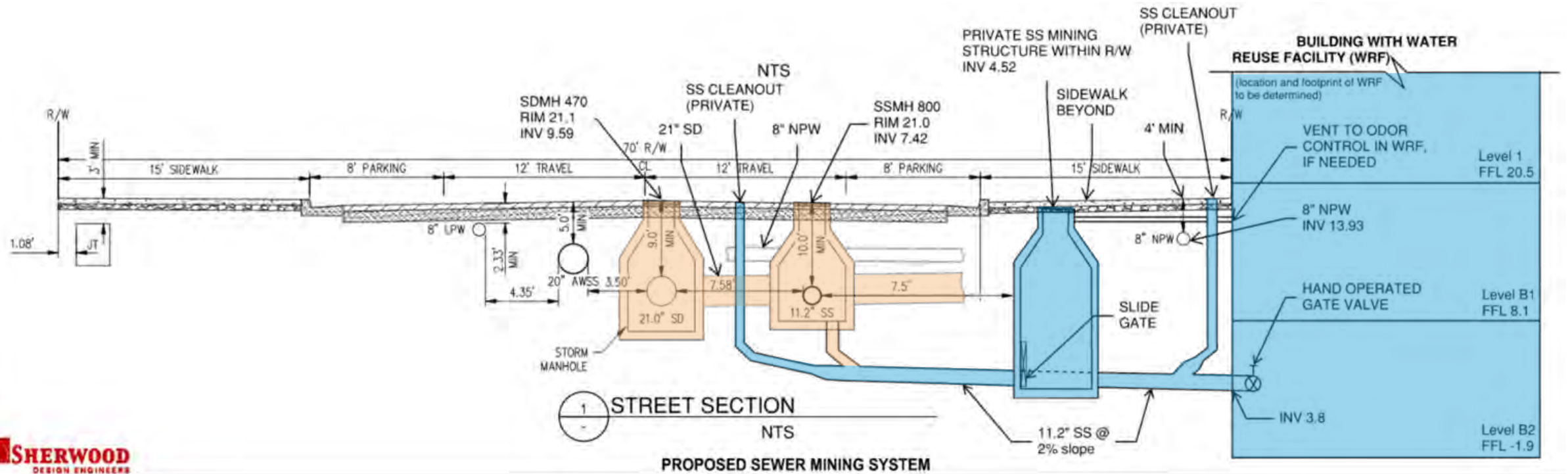
Sewer Mining Advantages

- Steady Influent Flow, no need to design for peak factors
- No on-site solids handling (*return to sewer*)
- Ease of startup, especially for seasonal operation - can return effluent to sewer until biology stabilizes
- Generates Reuse Water Near to the User - No need for lengthy, expensive purple pipe runs

Considerations

- What infrastructure is 'public'? (*maintained by municipality?*)
- What infrastructure is 'private'? (*operated and maintained by Owner?*)
- Design needs to consider scour velocity (*ensure adequate flows remain in pipe*)
- Will wastewater source be guaranteed? Owner only likely to invest if wastewater supply is secured for the future (*what happens if the municipality wants the resource in the future?*)

LESSON #2: SEWER MINING (CONT.)



LESSON #3: INDUSTRY DELIVERY ARRANGEMENTS AND ROLES NOT WELL ESTABLISHED & NEED TO BE DEFINED FOR A SPECIFIC PROJECT

Many delivery arrangements possible, roles and responsibilities should be established early

- In-building treatment facilities are relatively new - no established delivery mechanism and many developers, contractors are not familiar with requirements
- In building systems involve many disciplines: plumbing, mechanical, structural, waterproofing, electrical, irrigation, landscape, civil
- Some equipment vendors are able to provide DB, DBOM, while others only sell equipment. Integration with several disciplines needed
- Project anecdotes:
 - *“It’s like any other piece of equipment - what about this is different than having a GC buy an elevator?”*
 - General contractor and MEP subconsultants - especially in areas without familiarity with reuse refusing to take on risk. Equipment contracted directly by Owner instead.



Ecovie Perspective

Ecovie®

BOB DREW - Founder



WATER RESILIENT COMMUNITIES, ONE BUILDING AT A TIME



Vision:

Onsite water supply has a real impact on overall water supply and discharge moving beyond site-by-site niche benefits.

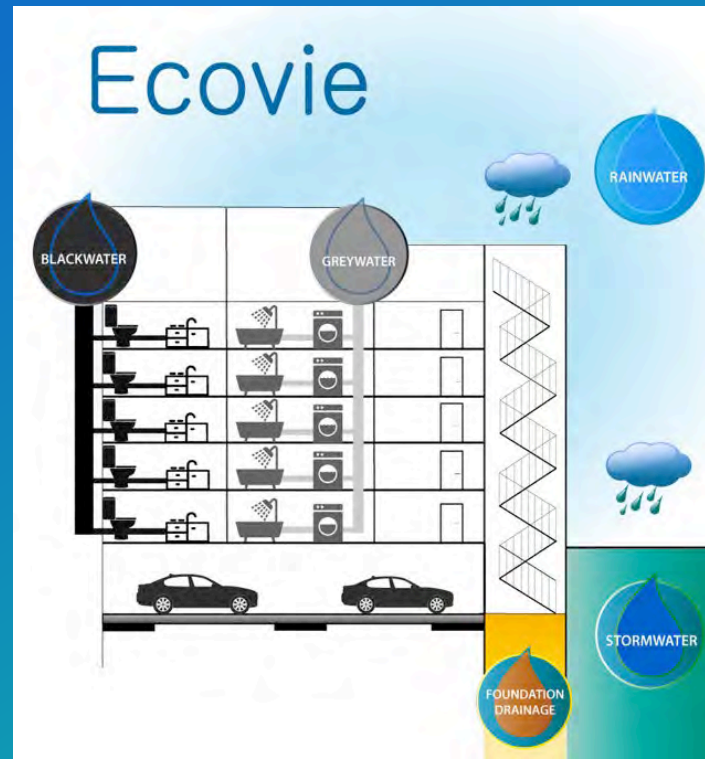


Drivers to Achieve Vision

**WIDESPREAD
ADOPTION**



**PUBLIC
SAFETY**



Public Safety

Water Abundance – Clean Waterways

LRV's to Assure Safety for Non-Potable

Regrowth – Low BOD, Residual

Non-Pathogenic Contaminants



Adoption Rate

Public Acceptance - Safety

Lower System Complexity

Lower Capital and Operating Cost

Higher System Reliability

Ease of Permitting

Incentives – Carrots and Sticks



Challenges

Variation Across Jurisdictions

Incorporating New Technologies

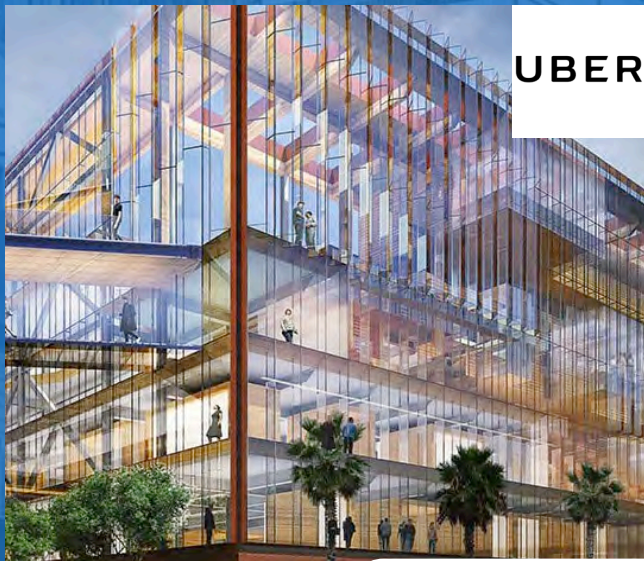
3rd Party LRV Protocol

Lack of Data on Risks – Leads to Higher LRT's



Project Experience

ECOVIE, CREATING WATER RESILIENT COMMUNITIES ONE BUILDING AT A TIME



Water Supply: 700 KGAL/Y
Source: RW-GW
Use: Irrigation, toilet
GW Process: MBR + UV
RW Process: Filter+UV

Learning:
LRV for Proprietary Process
NSF 350 Certified

Water Supply: 14 MGY
Source: Rainwater
Use: Cooling Tower
Process: Filtration + UV

Learning:
Common Approved Unit Ops
Approval Methodology

THANKS FOR YOUR TIME



ECOVIE

ON-SITE WATER MANAGEMENT



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