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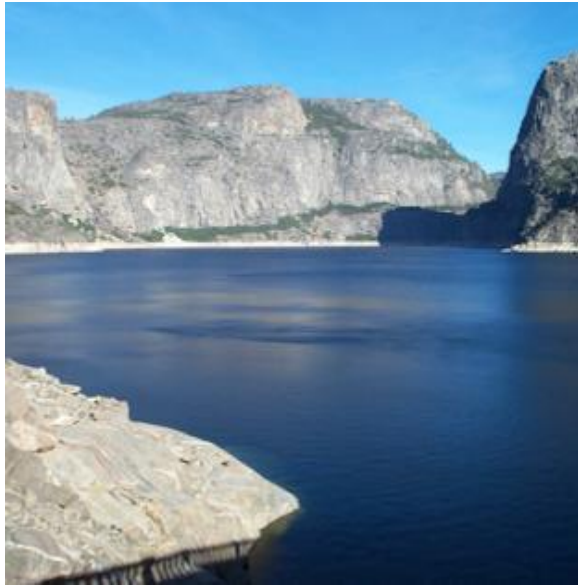
#ZeroNetWater

Re-imagining Water Resources in the Built Environment

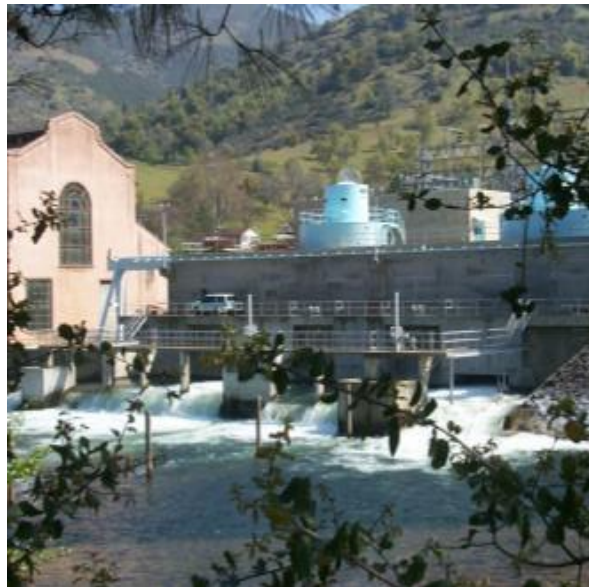
Paula Kehoe
Director of Water Resources
San Francisco Public Utilities Commission
June 30, 2016



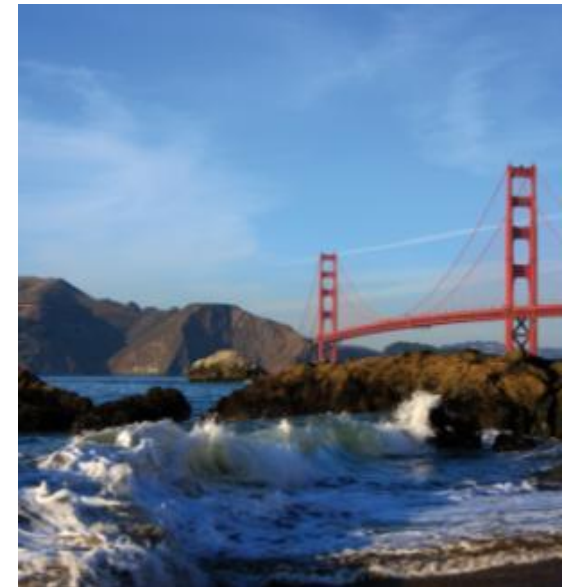
San Francisco Public Utilities Commission (SFPUC)



Water: delivering high quality water every day to 2.6 million people

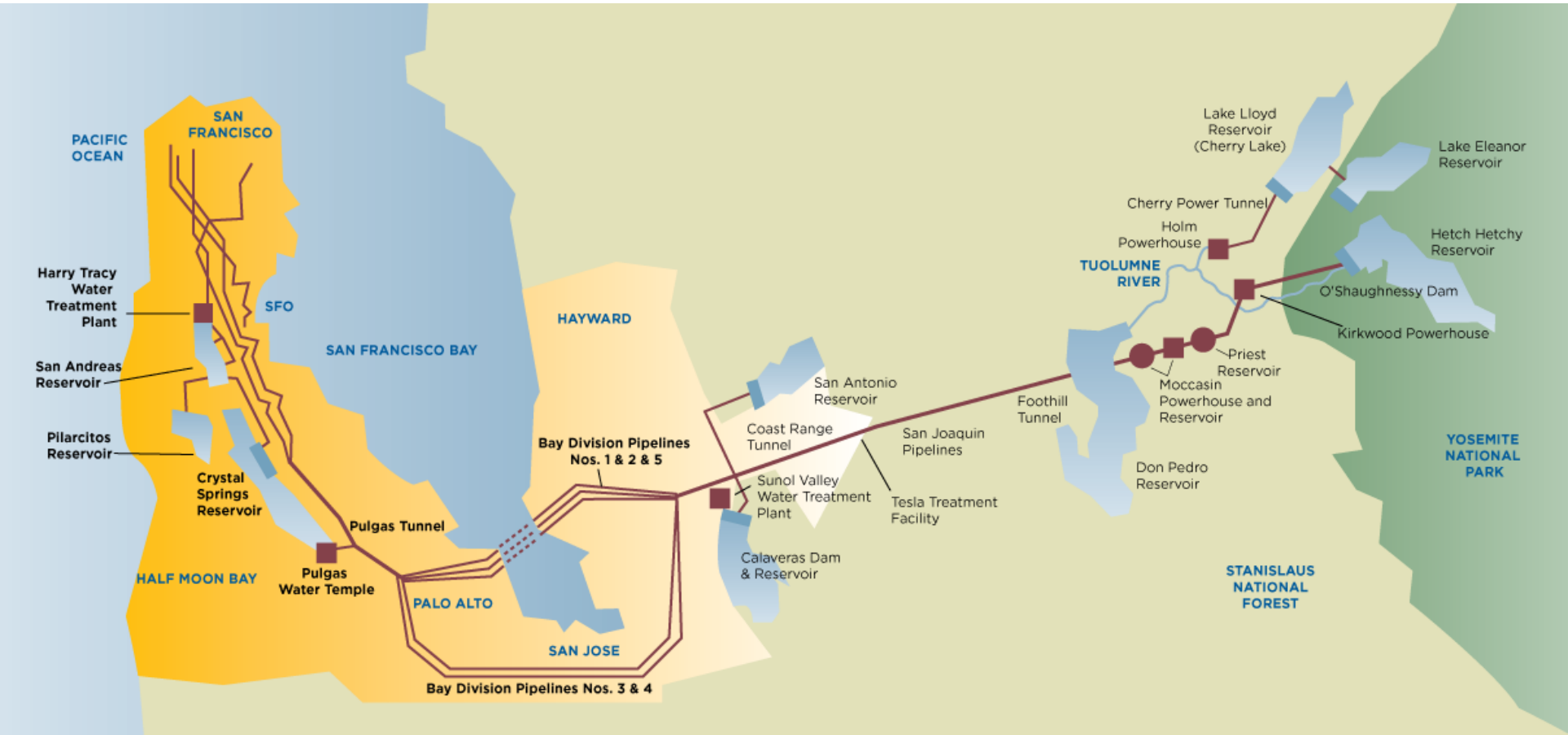


Power: generating clean energy



Wastewater: operating a combined sewer system

SFPUC Provides Water to 2.6 Million People



Respond to Aging & Vulnerable Water Infrastructure





HETCH HETCHY

+ LOCAL WATER

Better together.

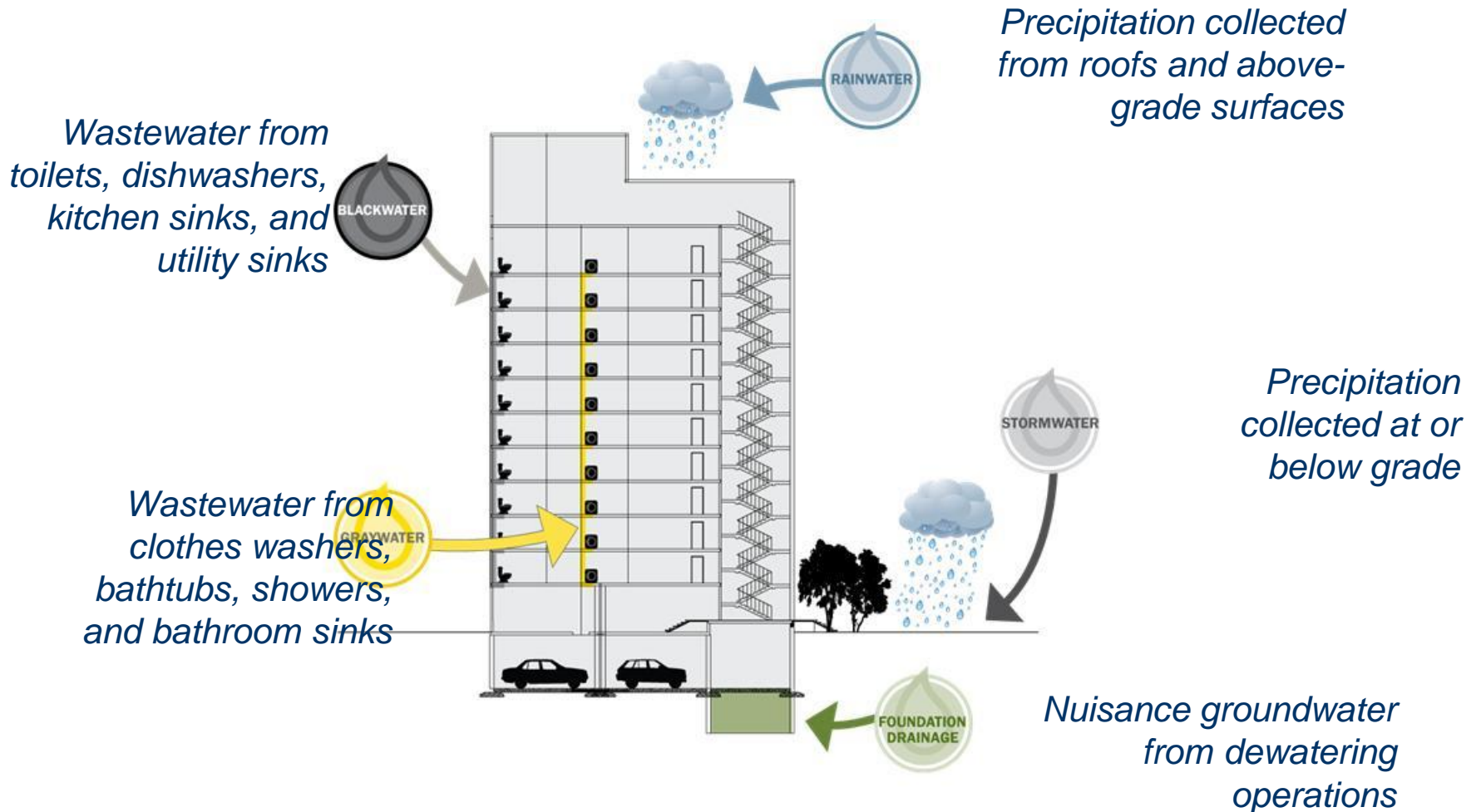
Conservation

Groundwater

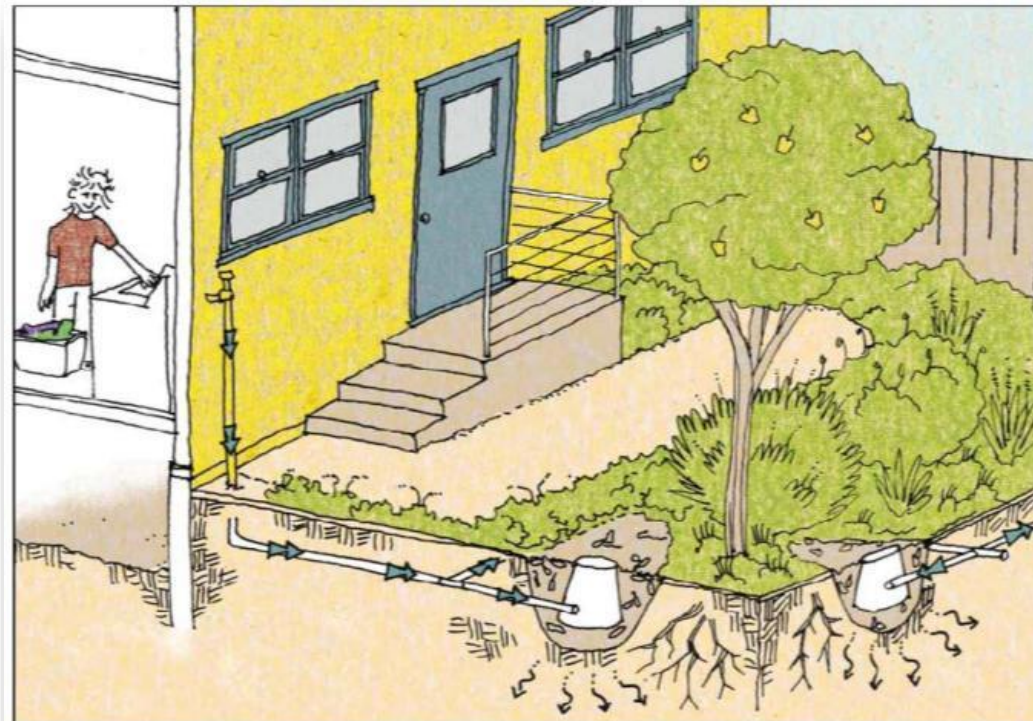
Recycled Water

Non-potable Water

Types of Alternate Water Sources for Non-potable Applications



Residential Programs



SFPUC Headquarters Incorporates Onsite Water Systems



Interest from Developers to Collect & Treat Water Onsite



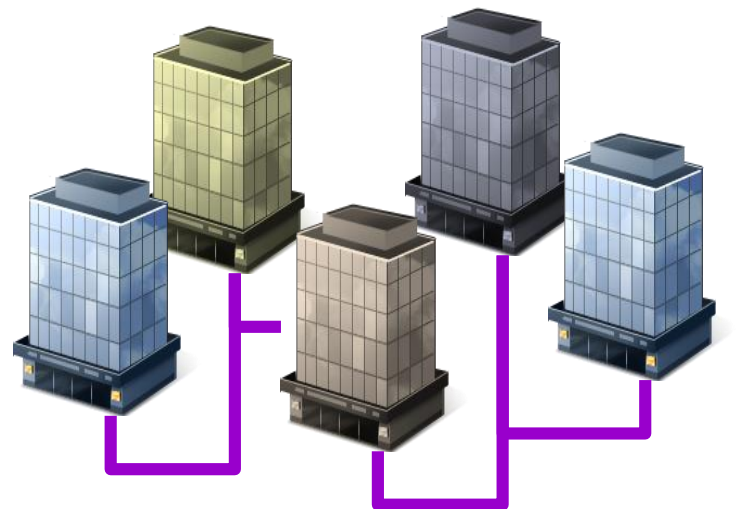


San Francisco Ordinance Provides Oversight and Management

SFPUC	SFDPH	SFDBI	SFDPW
Program Administration	Public Health	Construction	Right of Way and Mapping
<p>Review onsite non-potable water supplies & demands</p> <p>Administer citywide project tracking & annual potable offset achieved</p> <p>Provide technical support & outreach to developers</p> <p>Provide financial incentives to developers</p> <p>Cross Connection Test</p>	<p>Issue water quality & monitoring requirements</p> <p>Review and approve non-potable engineering report</p> <p>Issue permit to operate onsite systems</p> <p>Review water quality reporting</p>	<p>Conduct Plumbing Plan check and issue Plumbing Permit</p> <p>Inspect and approve system installations</p>	<p>Issue Encroachment Permits as needed for infrastructure in the Right-of-Way (if needed)</p> <p>Includes condition on a subdivision map or a parcel map requiring compliance with the Non-potable Ordinance prior to approval and issuance of said map (if applicable)</p>

Non-Potable Water Program Timeline

- 2012: Single building
- 2013: District scale systems
- 2015: Mandatory for projects over 250,000 square feet





San Francisco's Non-potable Water System Projects

San Francisco Public Utilities Commission
April, 2014

PG&E Office Building Retrofit

Foundation drainage for toilet and urinal flushing



Rainwater for toilet/urinal flushing and irrigation





San Francisco Public Safety Building

Rainwater, stormwater and graywater for toilet/urinal flushing and irrigation



Transbay Transit Center

Rainwater and graywater for toilet/urinal flushing and irrigation



181 Fremont Mixed Use Development

Graywater and rainwater for toilets and irrigation

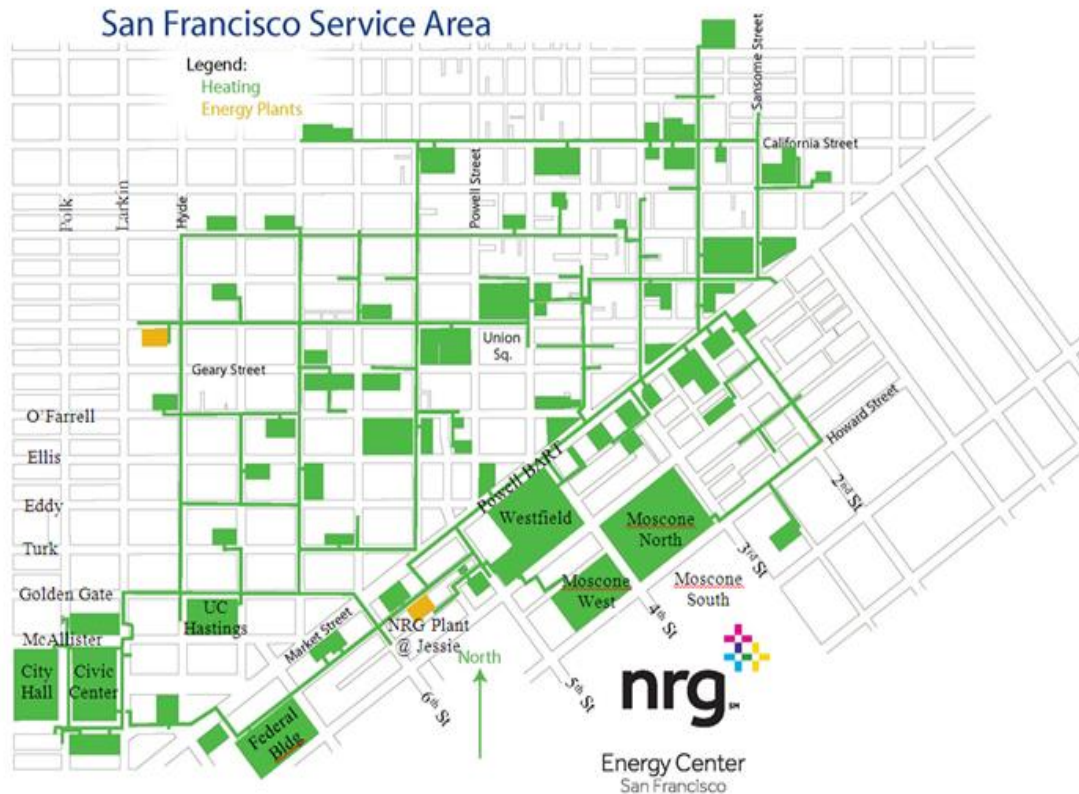


Moscone Convention Center Expansion

Foundation drainage and rainwater for toilet/urinal flushing, irrigation and street sweeping



Foundation drainage for steam loop



New Water Paradigm

- Develop new utility business models
- Pilot innovative technologies
- Future resource recovery facilities

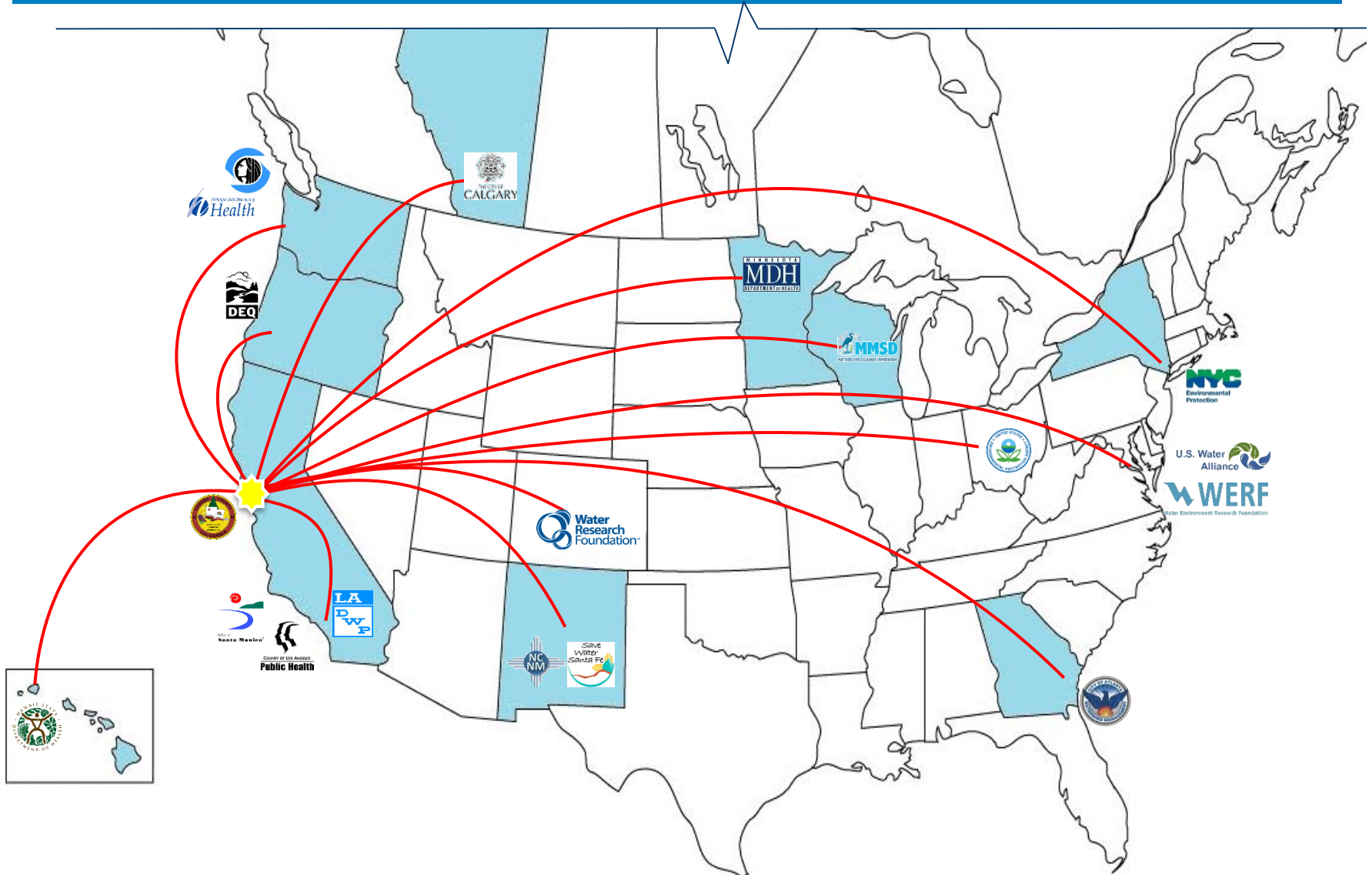


Innovation in Urban Water Systems

San Francisco • May 2014



Onsite Water Systems Summit San Francisco May 2014



BLUEPRINT for Onsite Water Systems

A Step-by-Step Guide for Developing a Local Program to Manage Onsite Water Systems



Public Health Collaborative



Recommendations for Decentralized Water Systems

- Final report available
September 2016
- San Francisco plans to
amend program
guidelines Fall 2016
- Draft policy for CA



National Blue Ribbon Commission

- Collaborate with state public health + water utilities across 9 states



**US Water
Alliance**

- Develop consistent state policies



San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

- Engage EPA



National Blue Ribbon Commission

- Develop new models and guidance for utilities
- Identify research needs
- Stakeholder Council
- Two year effort starting in Fall 2016



**US Water
Alliance**



San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

THANK YOU

sfwater.org/np

sfwater.org/np/iuws



Water Reuse in Multifamily Buildings

Bill Worthen, FAIA, LEED Fellow, GPR
Founding Principal

CONNECTING
POLICY AND
PRACTICE WITH
DESIGN

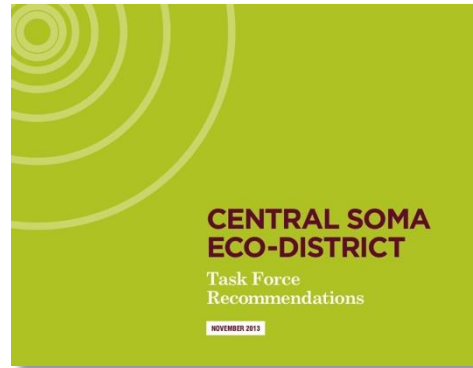
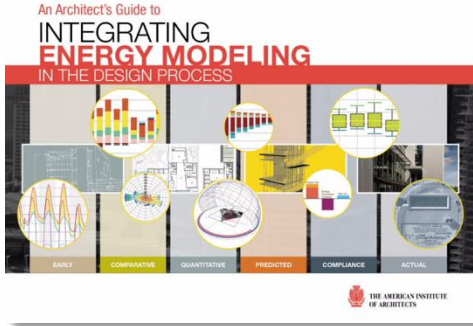
UR
BAN
FA
BRICK



SUSTAINABILITY CONSULTING AND COMMUNICATIONS
SAN FRANCISCO | NEW YORK

URBANFABRICK.COM

Policy & Practice Leadership



THE COLLABORATIVE

LEAN FORWARD MAKE A DIFFERENCE HAVE FUN
A 501c3 Public Benefit Corporation



THE COLLABORATIVE

A small group of specialty consultants and industry-wide experts who understand the value and nuanced complexity of design, performance, beauty, building science and the power of effective communication and storytelling and have fun doing it.



GOOD DESIGN



POWERED BY
COVO

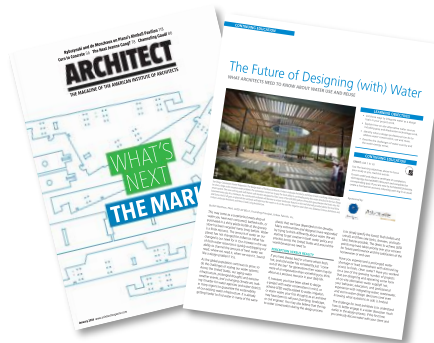
GOODDESIGNSF.COM

HELLOCOVO.COM

Design Professional's Practice Guide for Integrating: ONSITE WATER USE AND REUSE

Water is a finite resource. And yet almost all architects and engineers do not consider water reuse in the design, construction and operations of our buildings and neighborhoods.

95% COMMERCIAL OFFICE	50% RESIDENTIAL
<p>95% of water used in commercial office buildings can be supplied from non-potable sources</p> <ul style="list-style-type: none"> Toilet Flushing Cooling Tower Irrigation 	<p>50% of water used in multi-family residential homes can be supplied from non-potable sources</p> <ul style="list-style-type: none"> Irrigation Clothes Washer Toilet Flushing



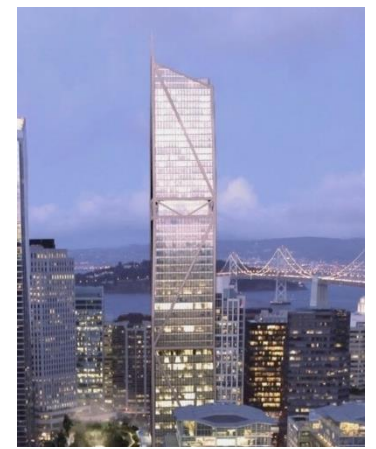
@AEC DAILY



URBAN

FABRICK

Sustainable Design Leadership



SOMA MISSION BAY HOTEL

RENOIR HOTEL

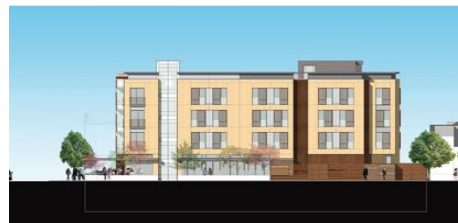
1500 MISSION

SF STATE SUSTAINABILITY
MASTER SITE

181 FREMONT



644 BROADWAY



MENLO PARK HOTEL



SFO TERMINAL I &
SFO GRAND HYATT



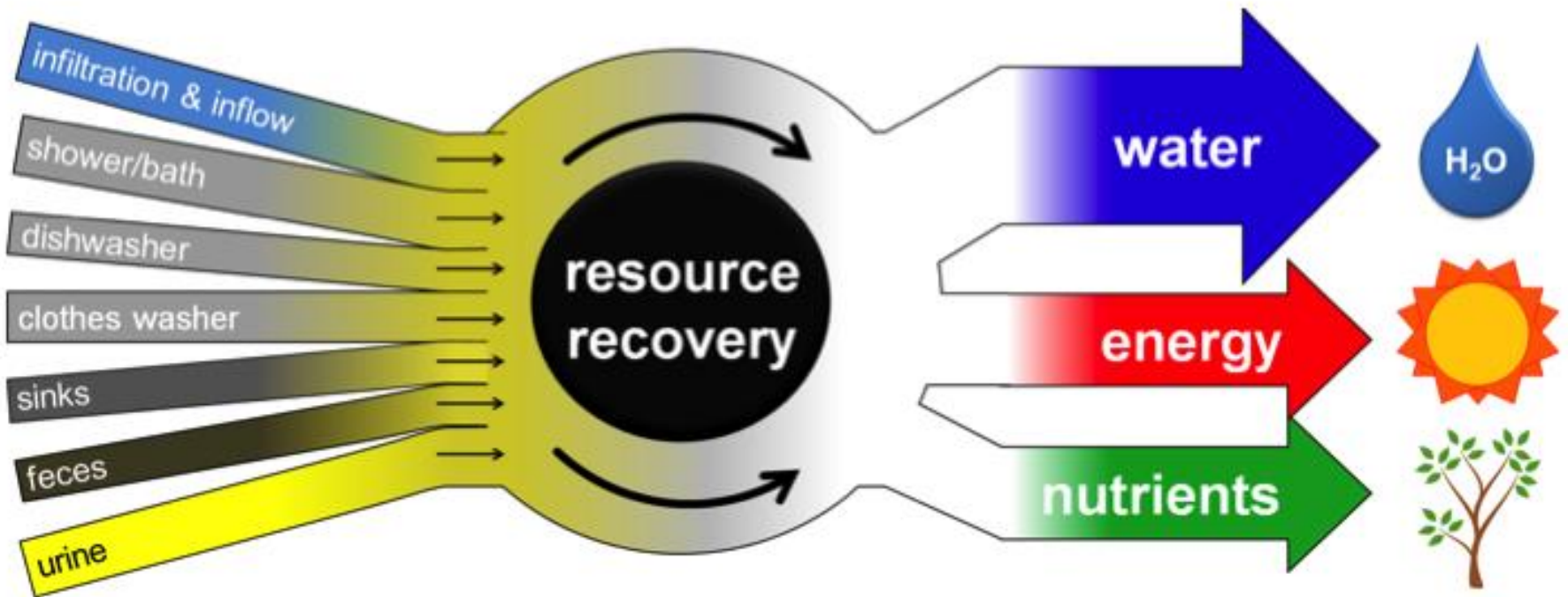
30 OTIS

CASTILLEJA SCHOOL
ROAD MAP

350 BUSH

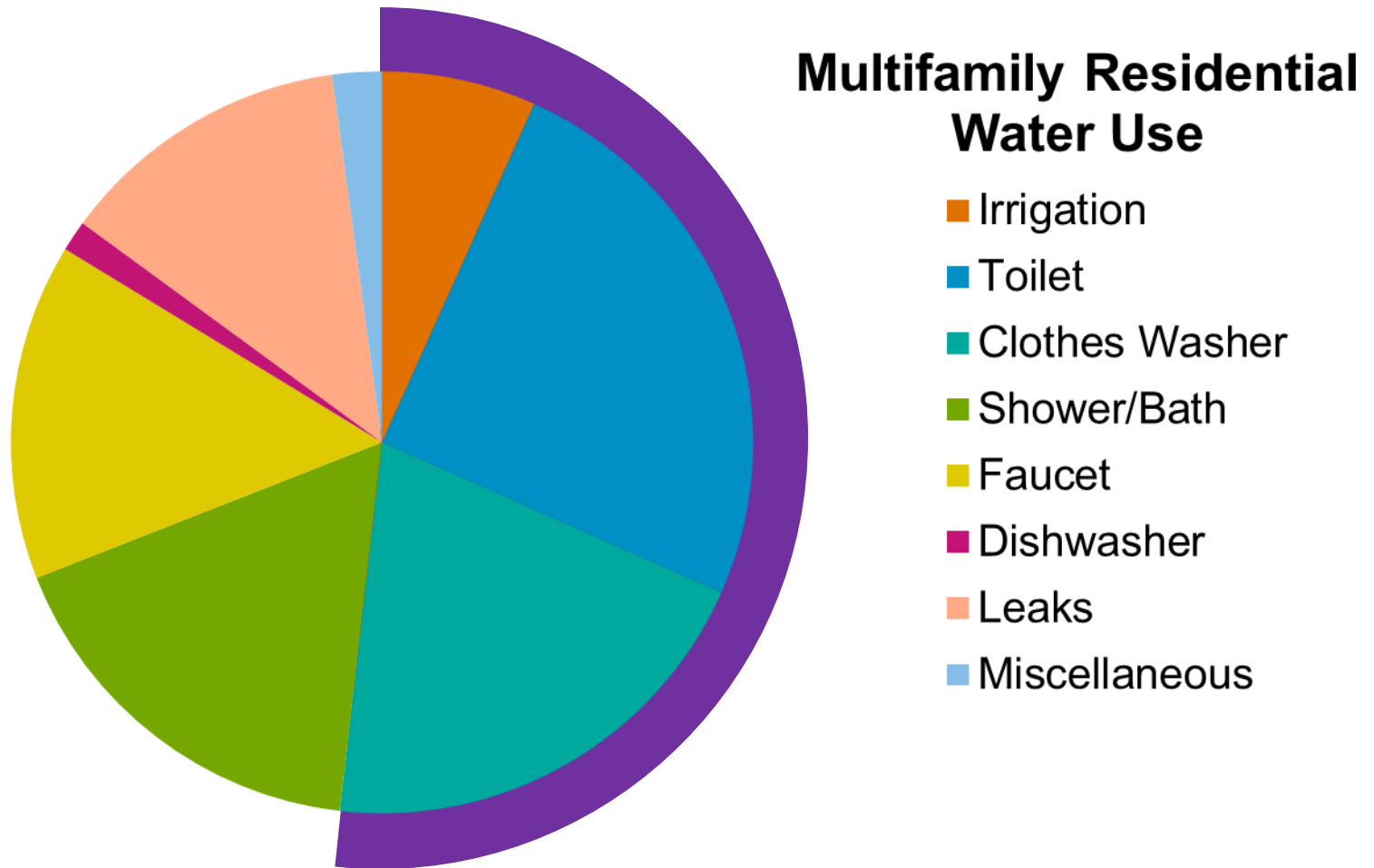


Key Concept: All water is a resource.



SOURCE: J.S. GUEST

Up to 50% of Demands are Non-potable in Multifamily Residential Buildings

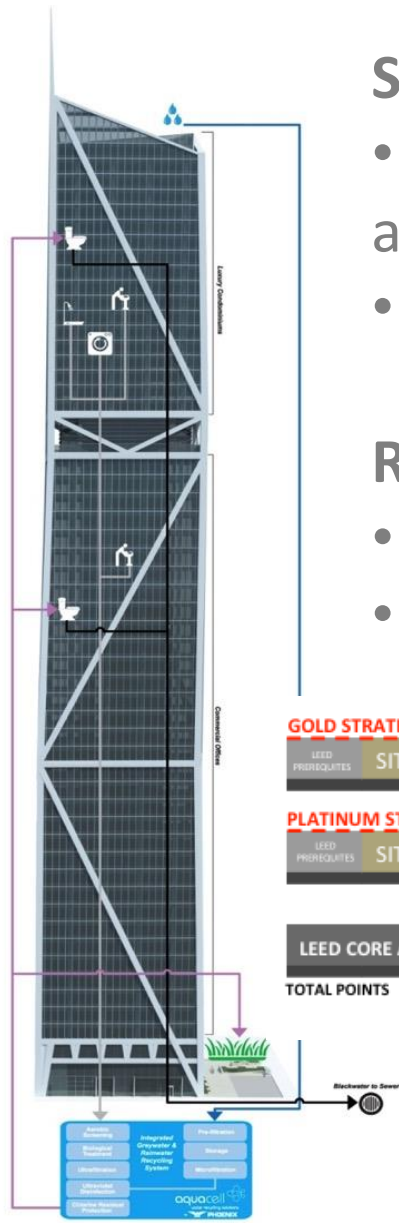


Source: adapted from Alliance for Water Efficiency



181 FREMONT



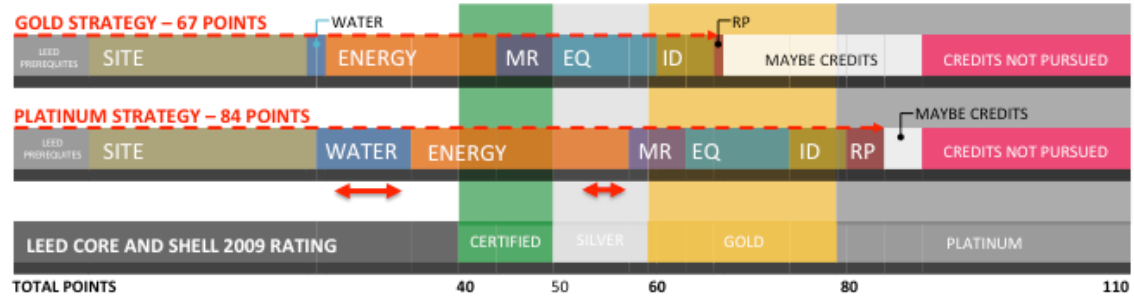
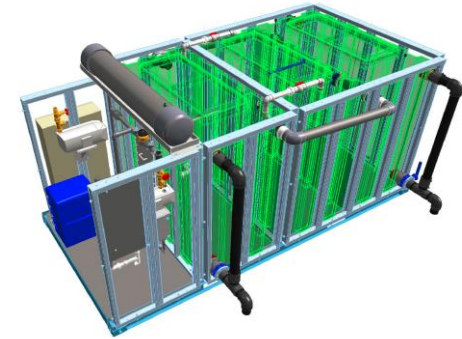


Source Water

- Graywater from luxury condos and commercial office
- Rainwater from roof

Reuse Applications

- Toilet flushing
- Irrigation



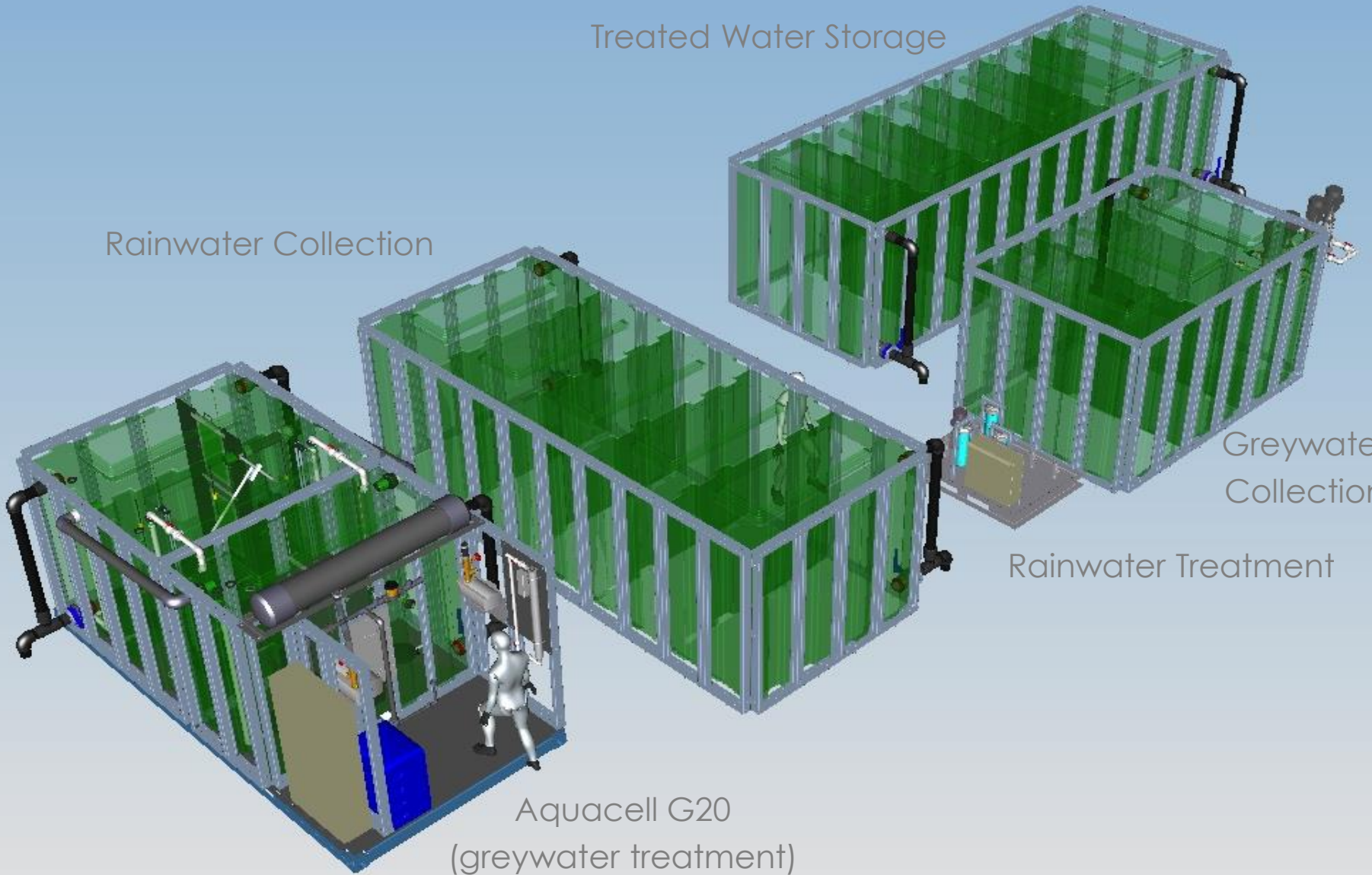
Treated Water Storage

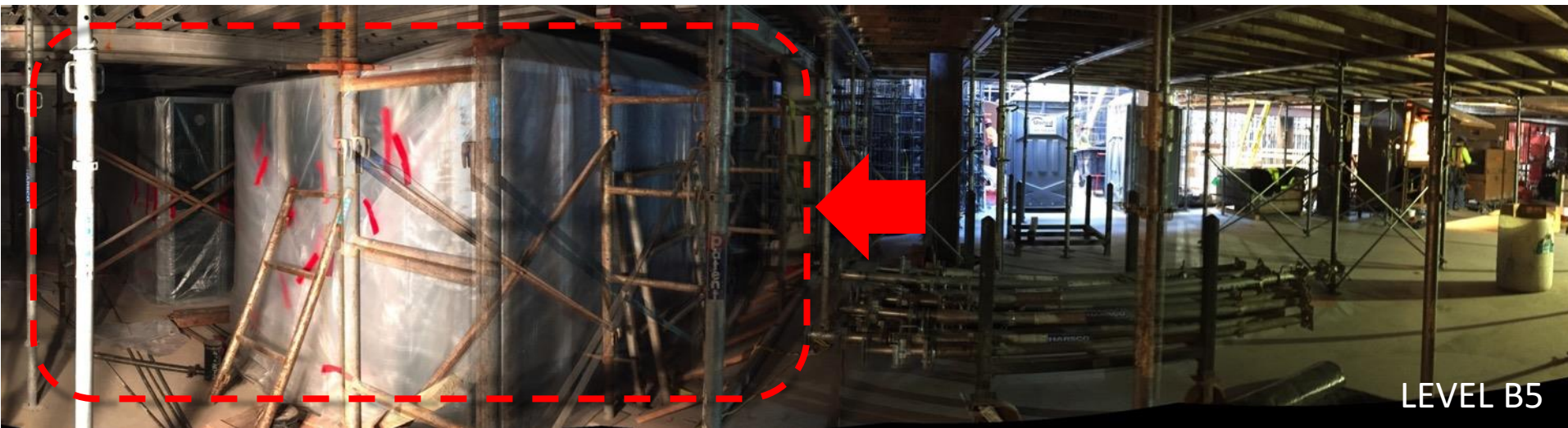
Rainwater Collection

Greywater
Collection

Rainwater Treatment

Aquacell G20
(greywater treatment)





LEVEL B5

January 2015

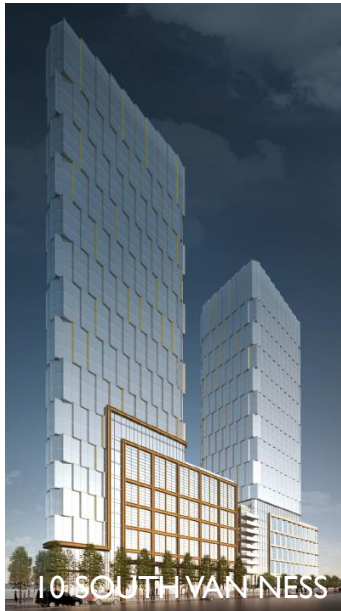


1500 MISSION



CANDLESTICK POINT CENTER

1395 22nd STREET



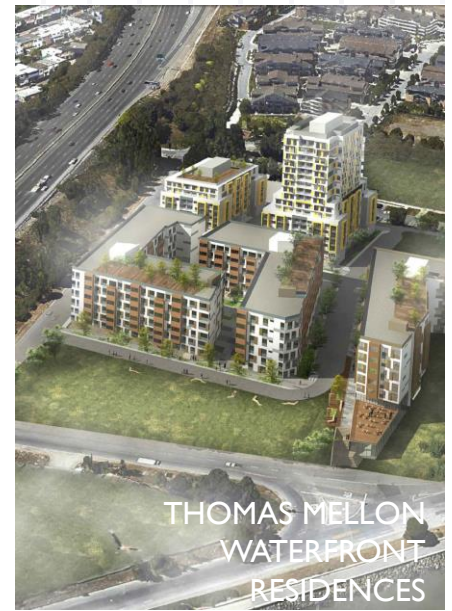
10 SOUTH VAN NESS



30 OTIS



BLOCK 9



THOMAS MELLON
WATERFRONT
RESIDENCES

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SAN FRANCISCO MULTIFAMILY RESIDENTIAL PROJECTS



Performance and Beauty

URBAN

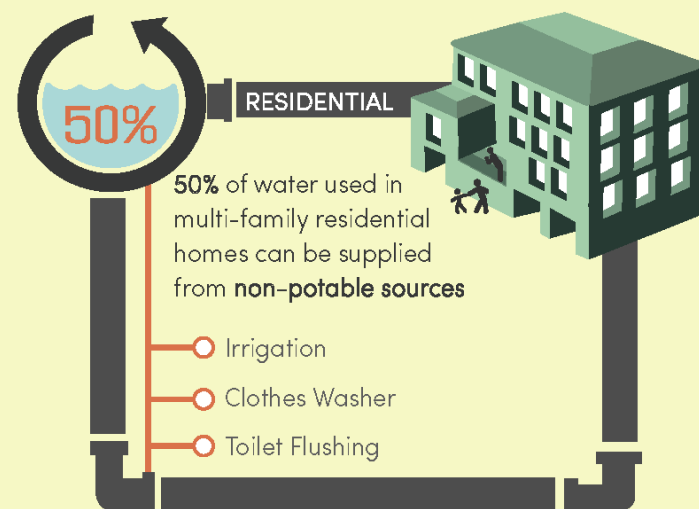
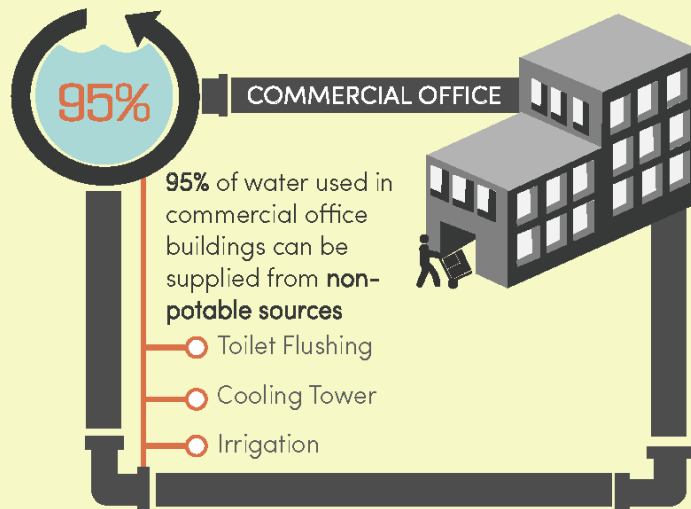
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ARE NOT MUTUALLY EXCLUSIVE

Design Professional's Practice Guide for Integrating:

ONSITE WATER USE AND REUSE

Water is a finite resource. And yet almost all architects and engineers do not consider water reuse in the design, construction and operations of our buildings and neighborhoods.



**Please participate in the September 2016 (30-day) Peer Review
LEAVE YOUR CARD WITH ME TO RECEIVE GUIDE UPDATES**

THANK YOU



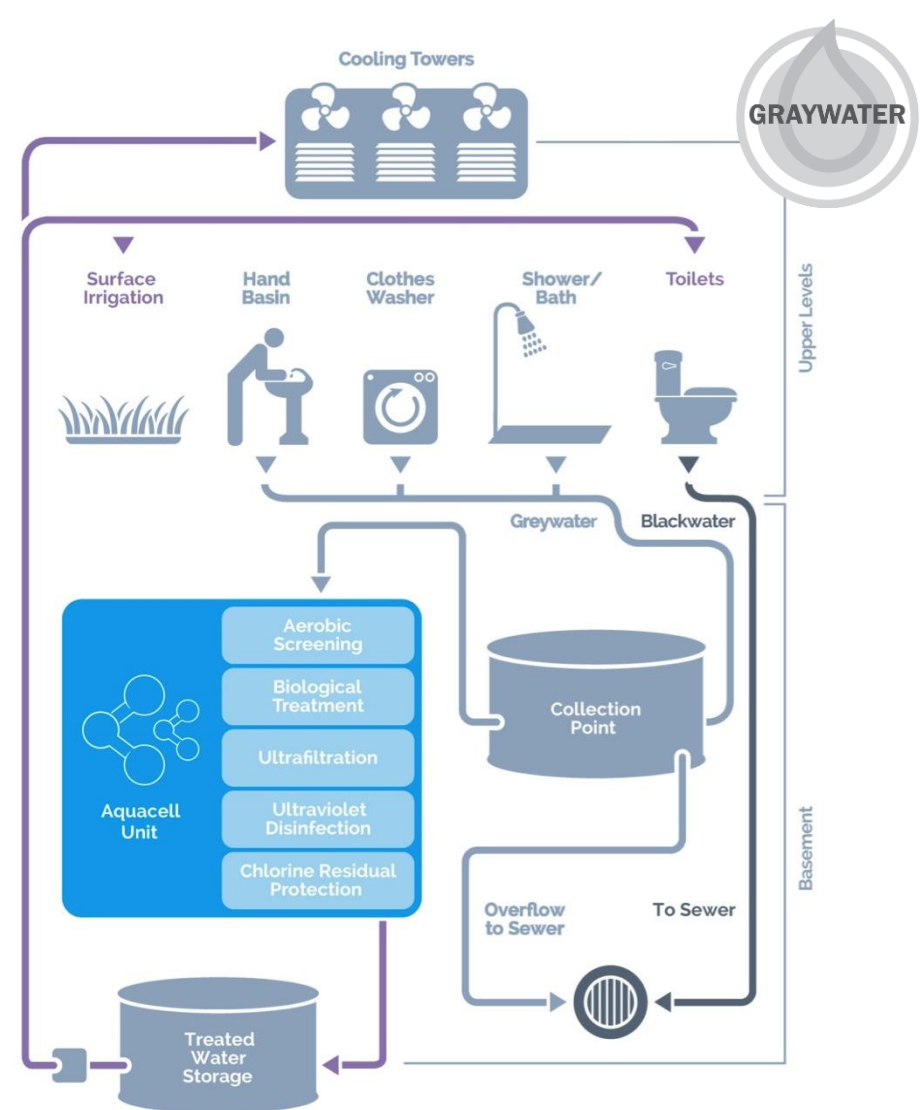
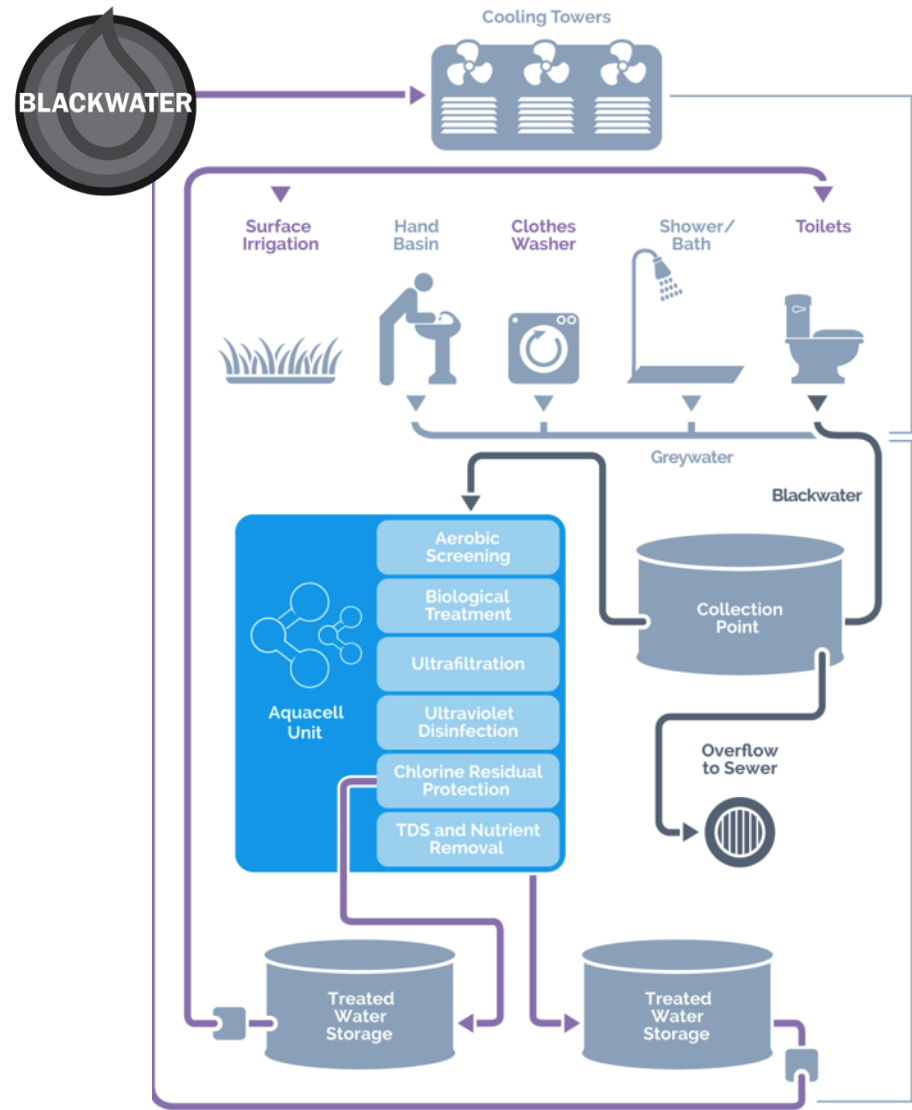
bill@urbanfabrick.com

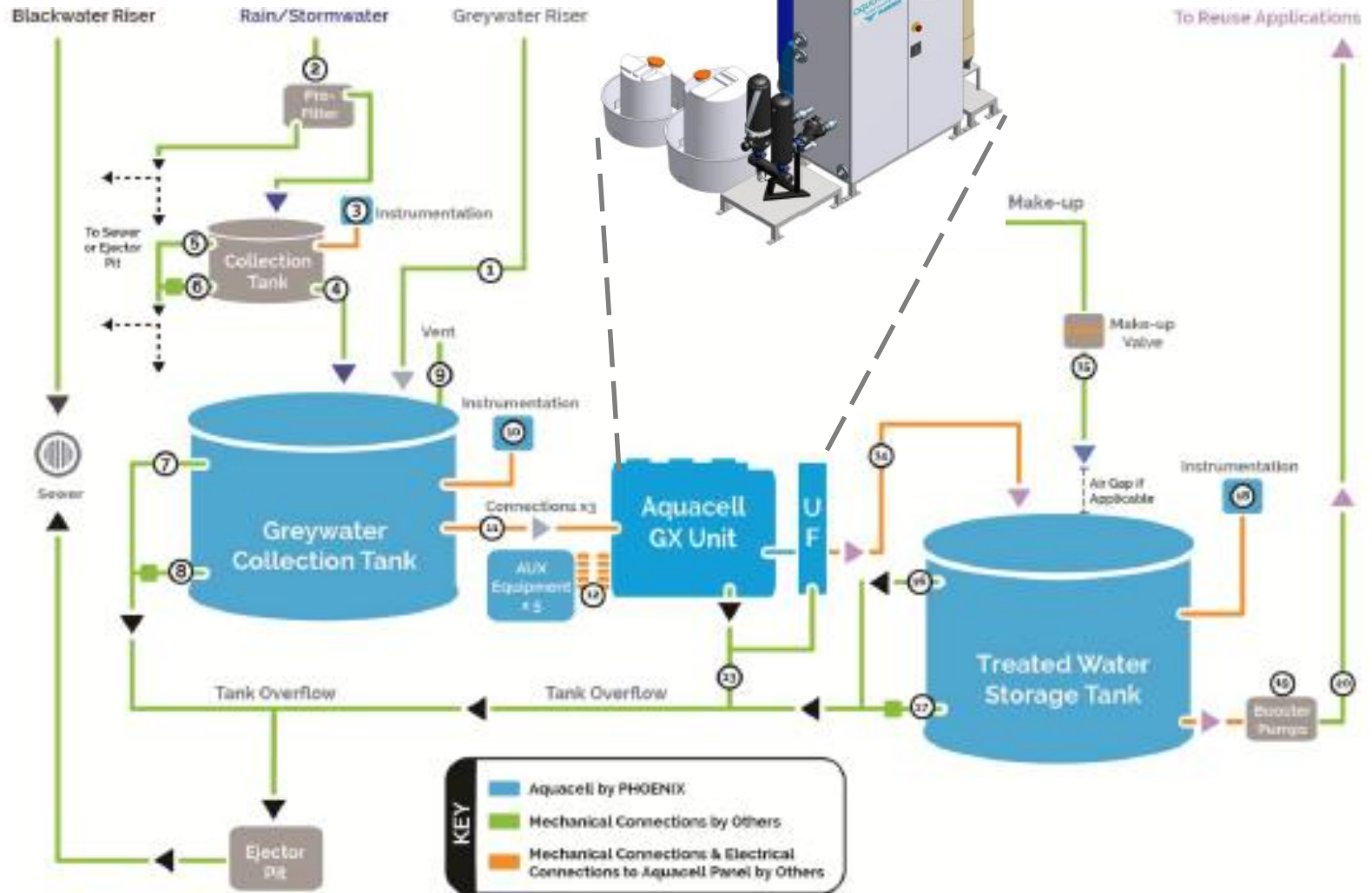
CONNECTING
POLICY AND
PRACTICE WITH
DESIGN

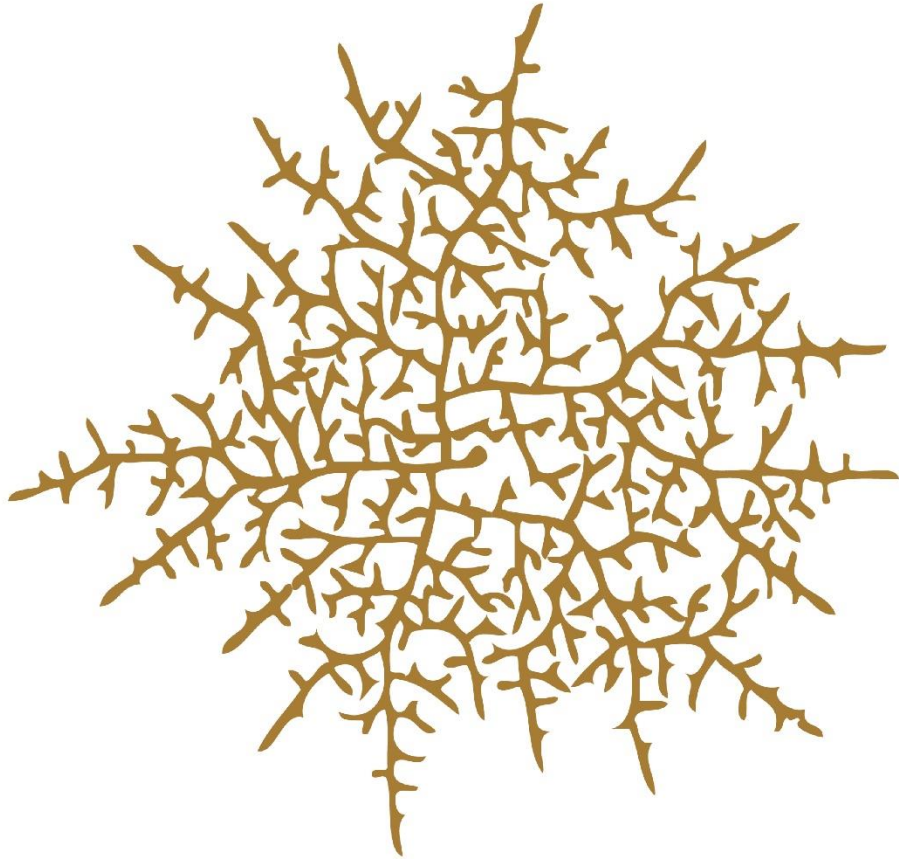
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hyphæ design laboratory

Ecological Design & Engineering

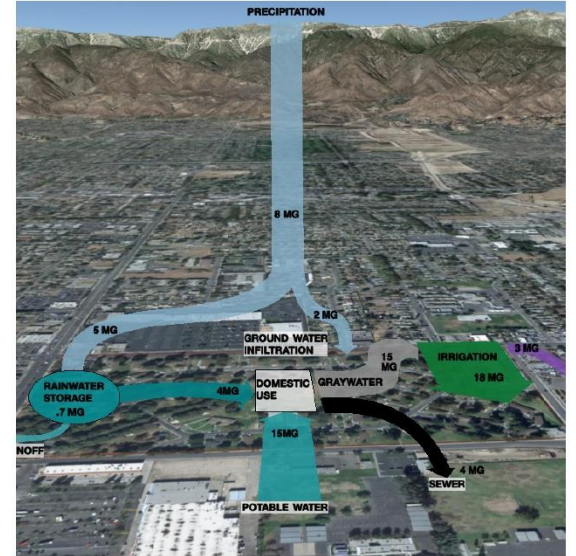
We work at different scales



SINGLE- FAMILY



MULTI-FAMILY



NEIGHBORHOOD



INSTITUTIONAL



INDUSTRIAL



MUNICIPAL

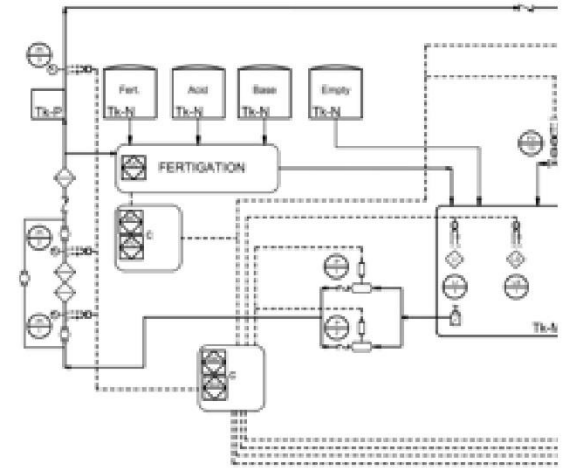
We work at different **times**



COMMUNITY

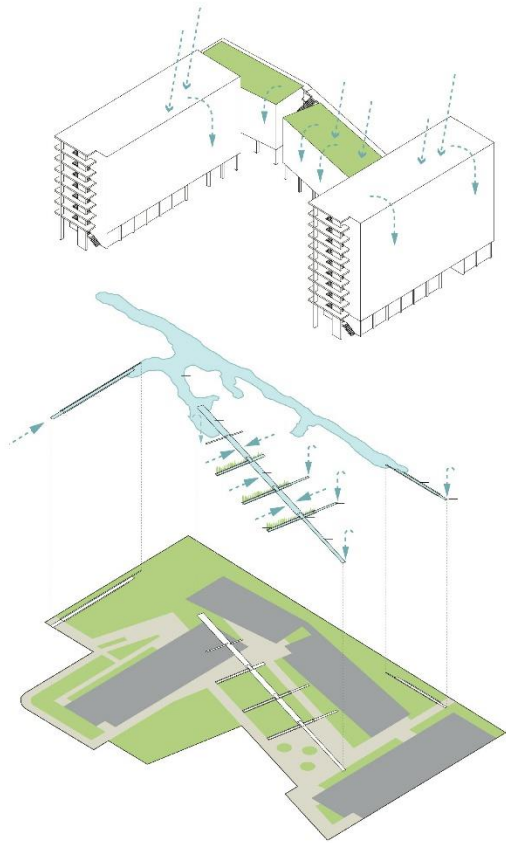


CONCEPTUAL DESIGN

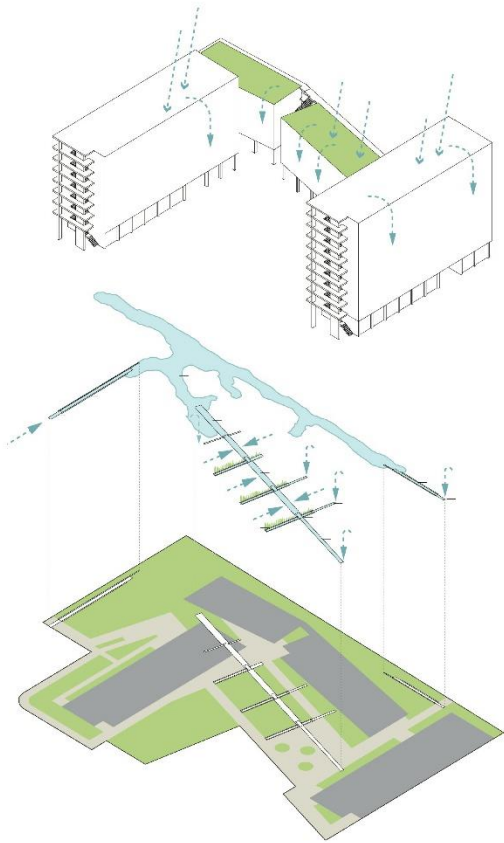


TECHNICAL ENGINEERING

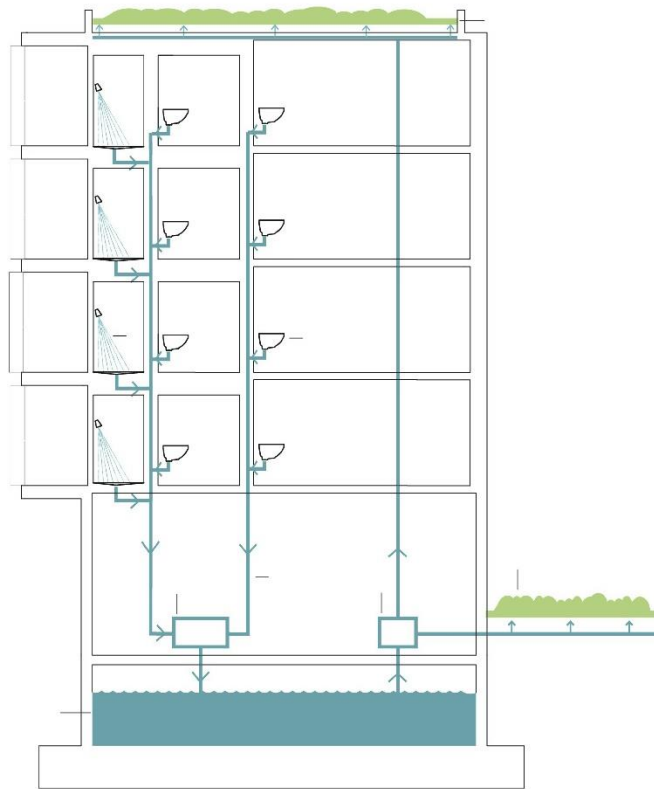
We work on different
scopes



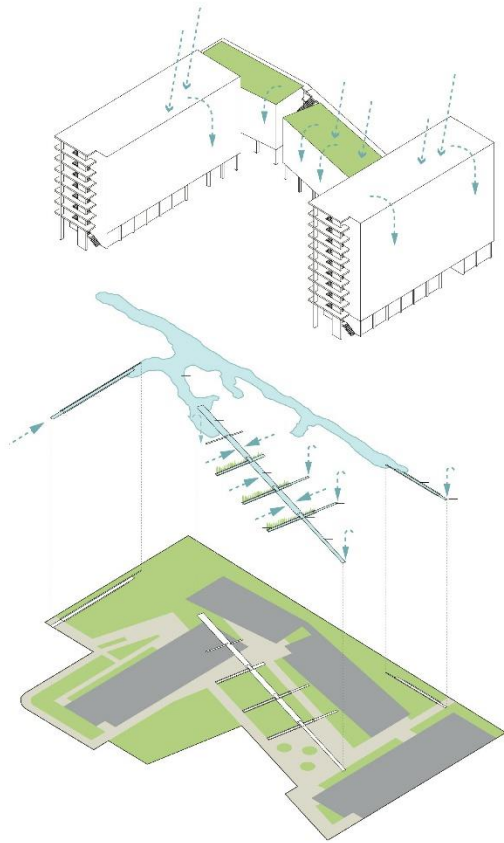
CIVIL ENGINEERING



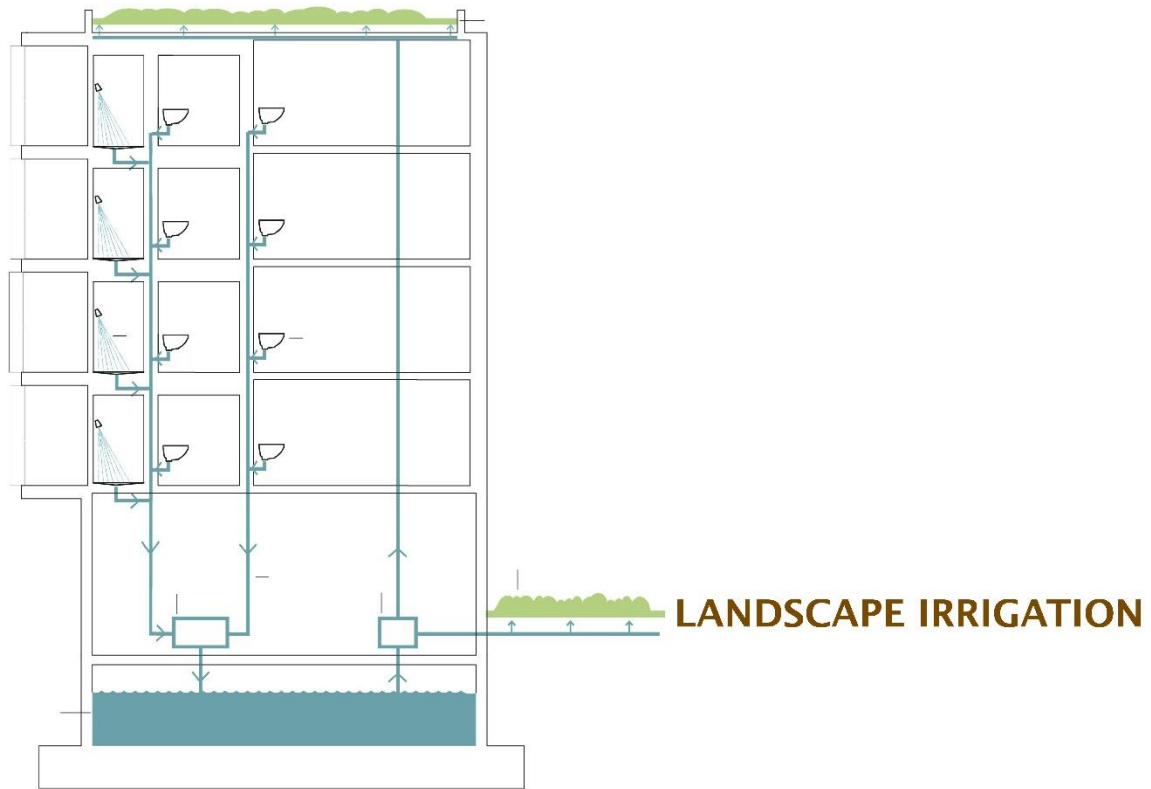
CIVIL ENGINEERING



M/E/P ENGINEERING



CIVIL ENGINEERING



M/E/P ENGINEERING

WATER REUSE OPTIONS :

GW

Grey Water

RW

Rain Water

GrW

Groundwater

MW

Mechanical Water

ReW

Reclaimed Water

BW

Black Water

PW

Potable Water

WATER REUSE SOURCES: In different building types

INSTITUTIONAL

MW / RW / RCW / GrW /
GW / BW / PW

COMMERCIAL

GW / MW / RW / BW / PW
RW / GW / PW

MULTI-FAMILY

GW / MW / RW / PW / GrW

SINGLE FAMILY

GW / RW / PW / GrW

RAINWATER REUSE OPTIONS : BY VARIOUS

PERMITTING

PW / RW / RCW / MW / GW

easy ← → hard

HIGHEST REUSE VALUE

GW / BW / MW / RCW /

appropriate ← → inappropriate

ROI & UPFRONT EXPENSE

PW / MW / GW / RW / RCW

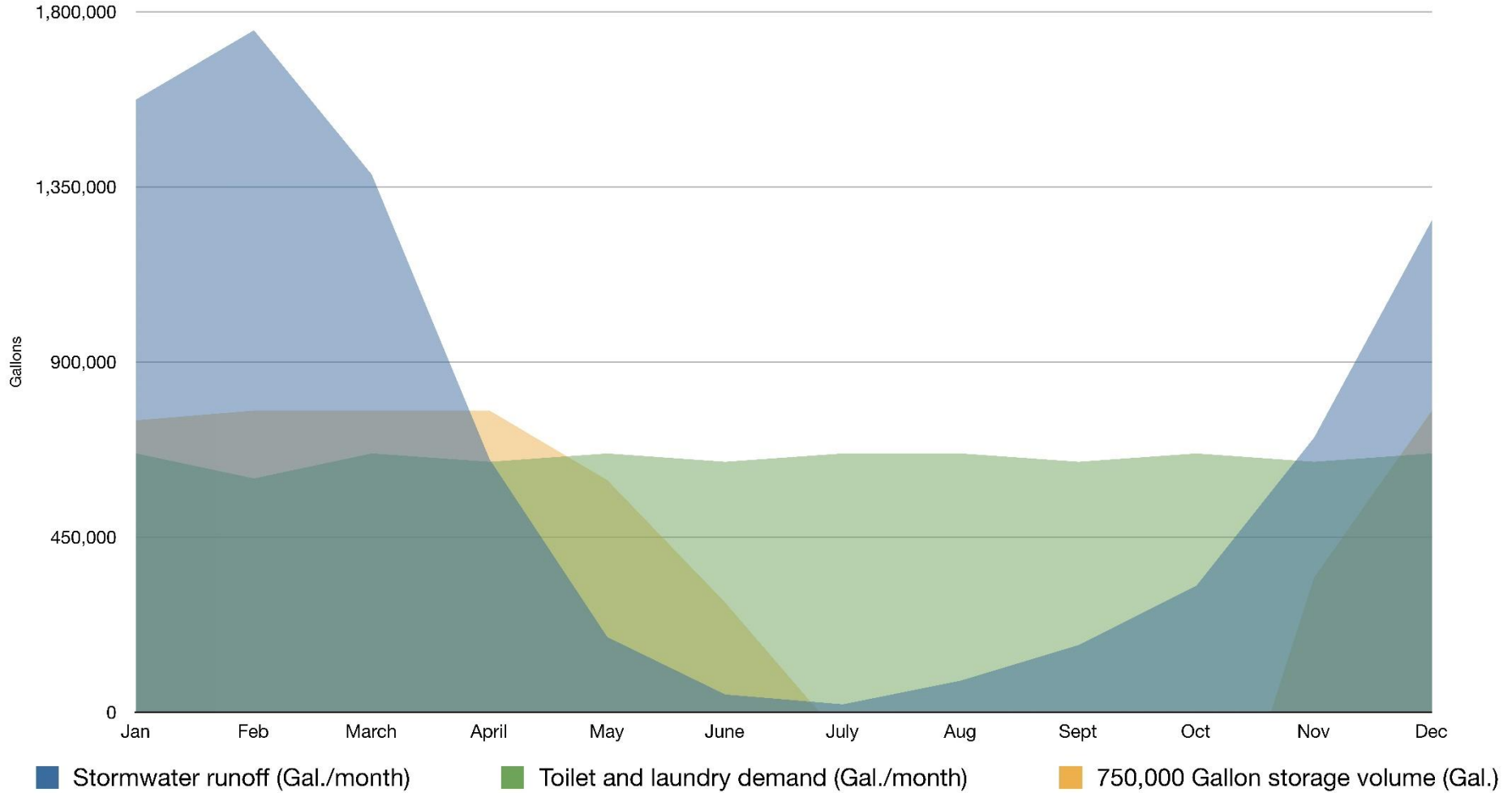
low ← → high

HYDRO CORRELATION

RCW / MW / GW / BW / RW

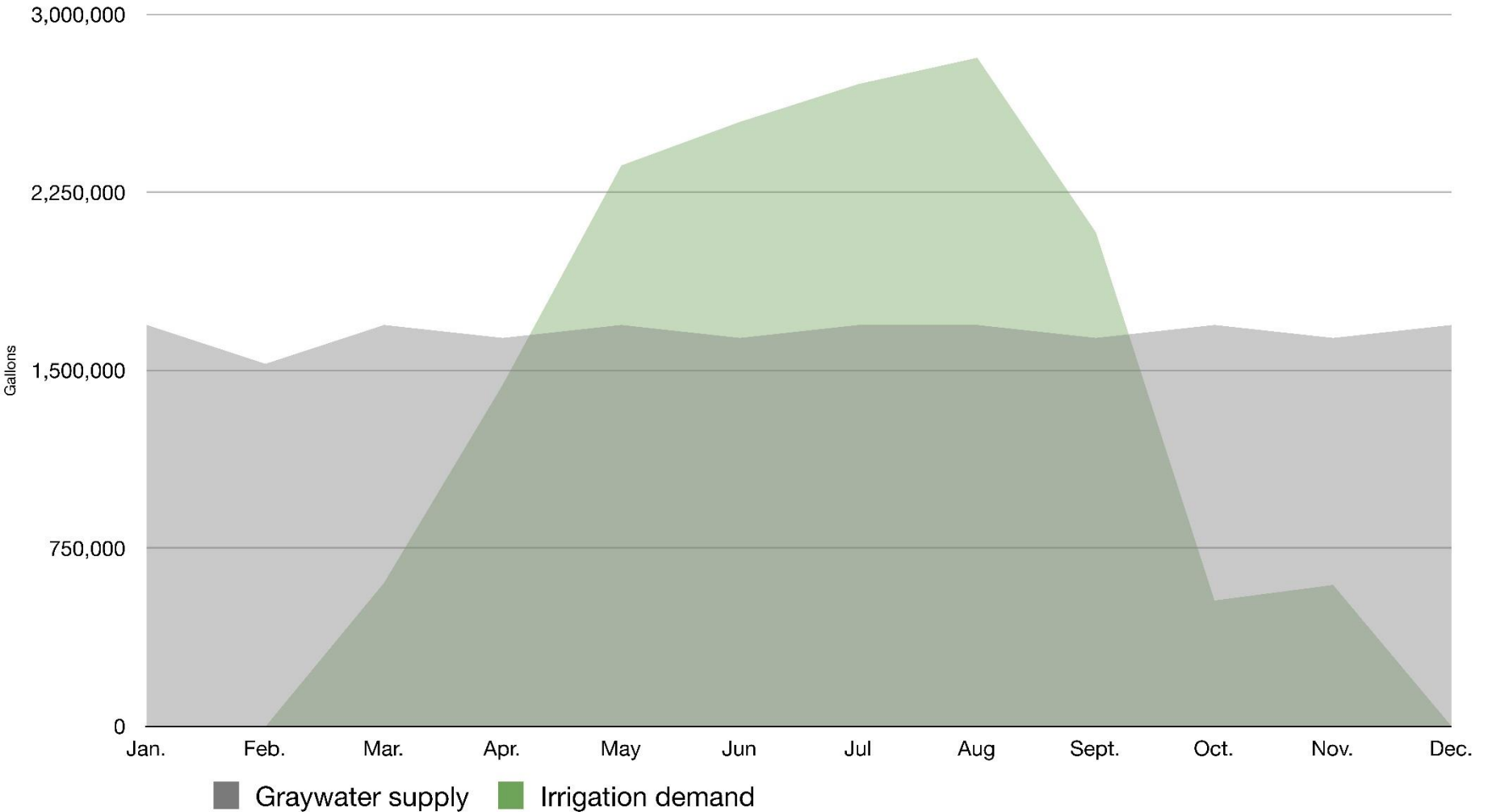
low ← → high

Rainwater for Toilet Flushing



Harvested rainwater for toilets and laundry saves million gallons of potable water per year and reduces these fixtures potable water use by 74%.

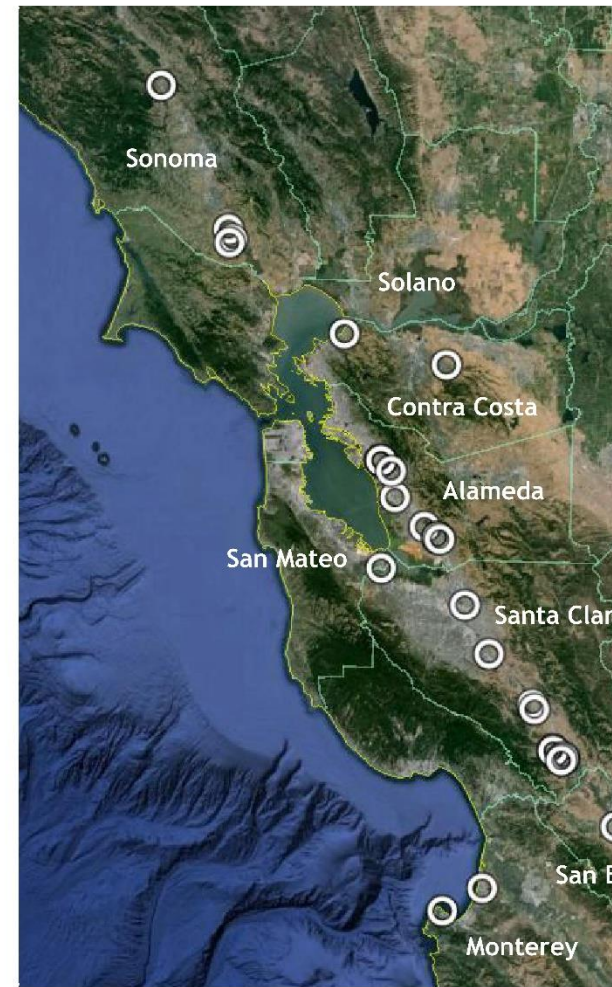
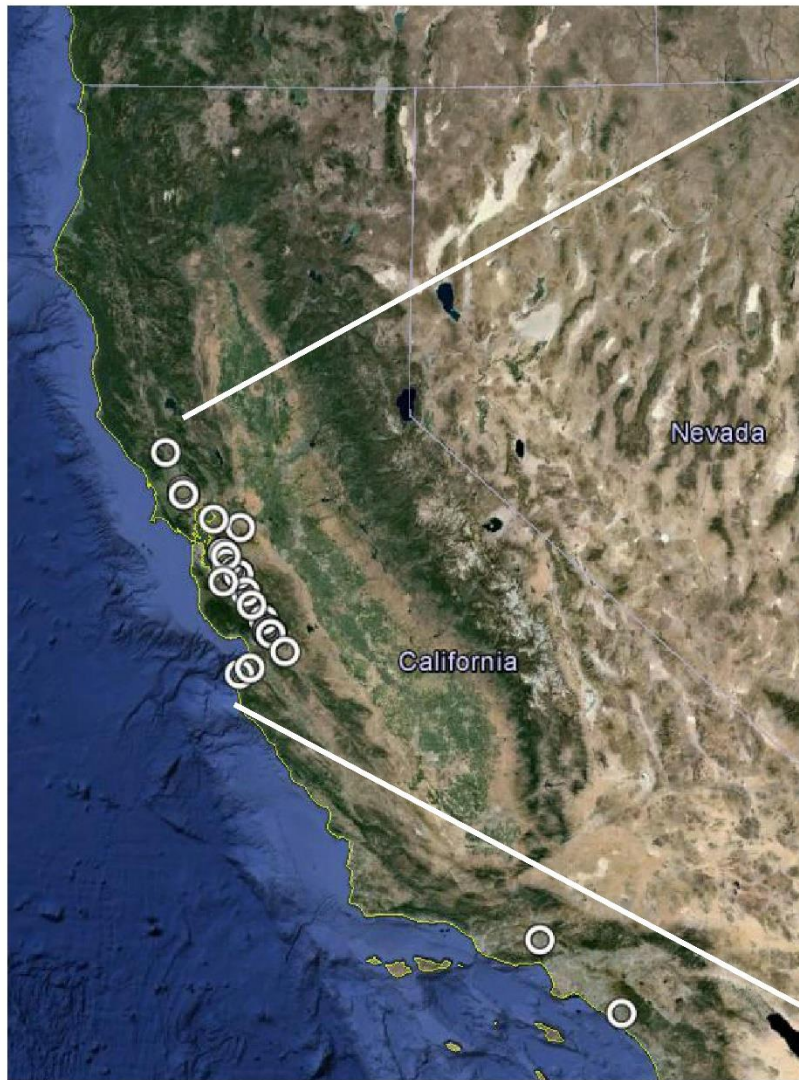
Graywater for Landscape Irrigation, Waterman Gardens



Graywater meets 75% of irrigation demand, reducing potable water use on the landscape by 17 million gallons per year.



- o Vista Apts
- nd Village
- es
- a Ranch
- hwood place
- own River
- ale Supportive Housing
- ook Place
- Gardens
- Lodge
- hine Lum Lodge
- Court Apartments
- Tree Apartments
- rey Villa
- celli
- c Grove Apartments
- o Park
- ood Lodge Apartments
- Court
- ia Manor
- o Village
- ore Glen
- edwoods Apartments
- ia Green
- Point
- ngton Creek
- er Creek
- cape Apartments



Visited

Urban Housing Water Conservation

19, 2015



PLIES



SYSTEM OPTIONS



REUSE

LAUNDRY TO LANDSCAPE DIRECT

BRANCHED DRAIN

PUMPED

FILTERED TO DRIP IRRIGATION

DIRECT BATHROOM SINK TO TOILET

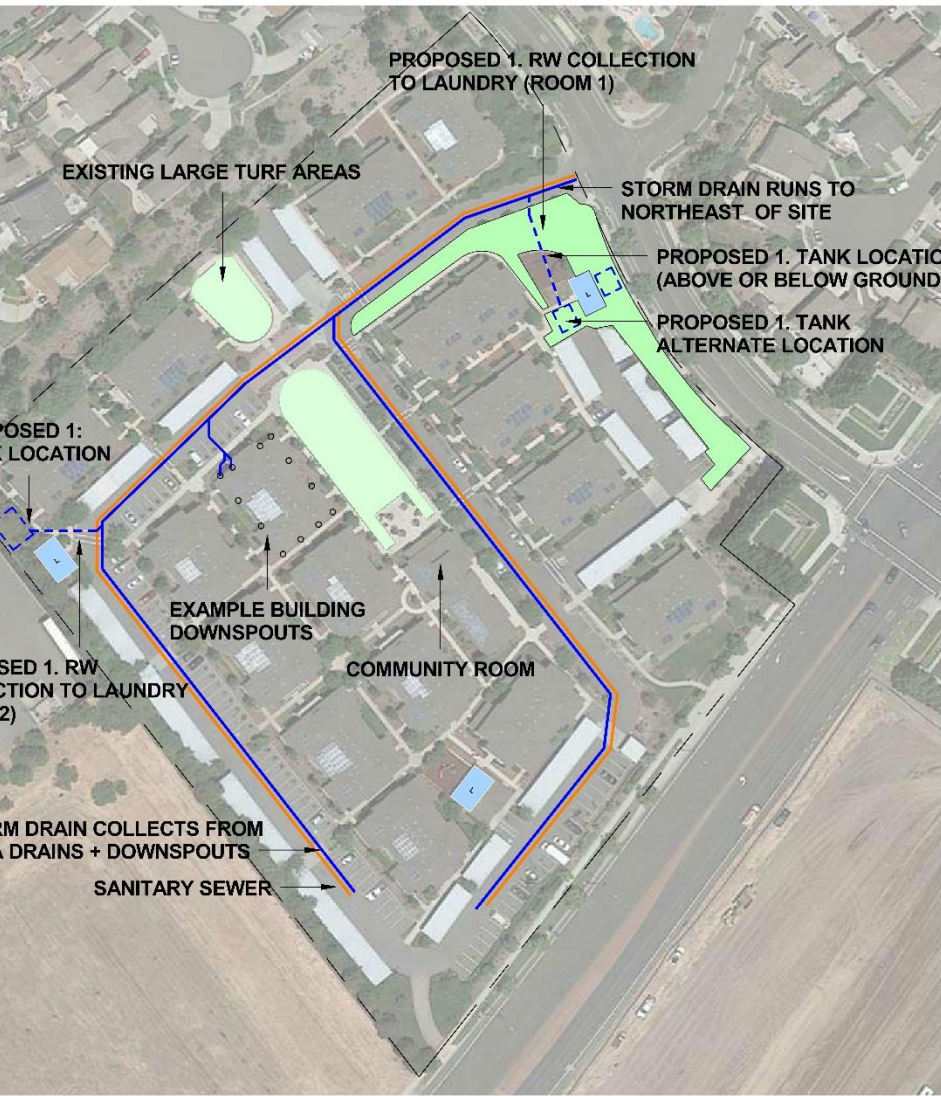
FILTERED & UV TREATED

LANDSCAPE



INDOOR NON-POTABLE

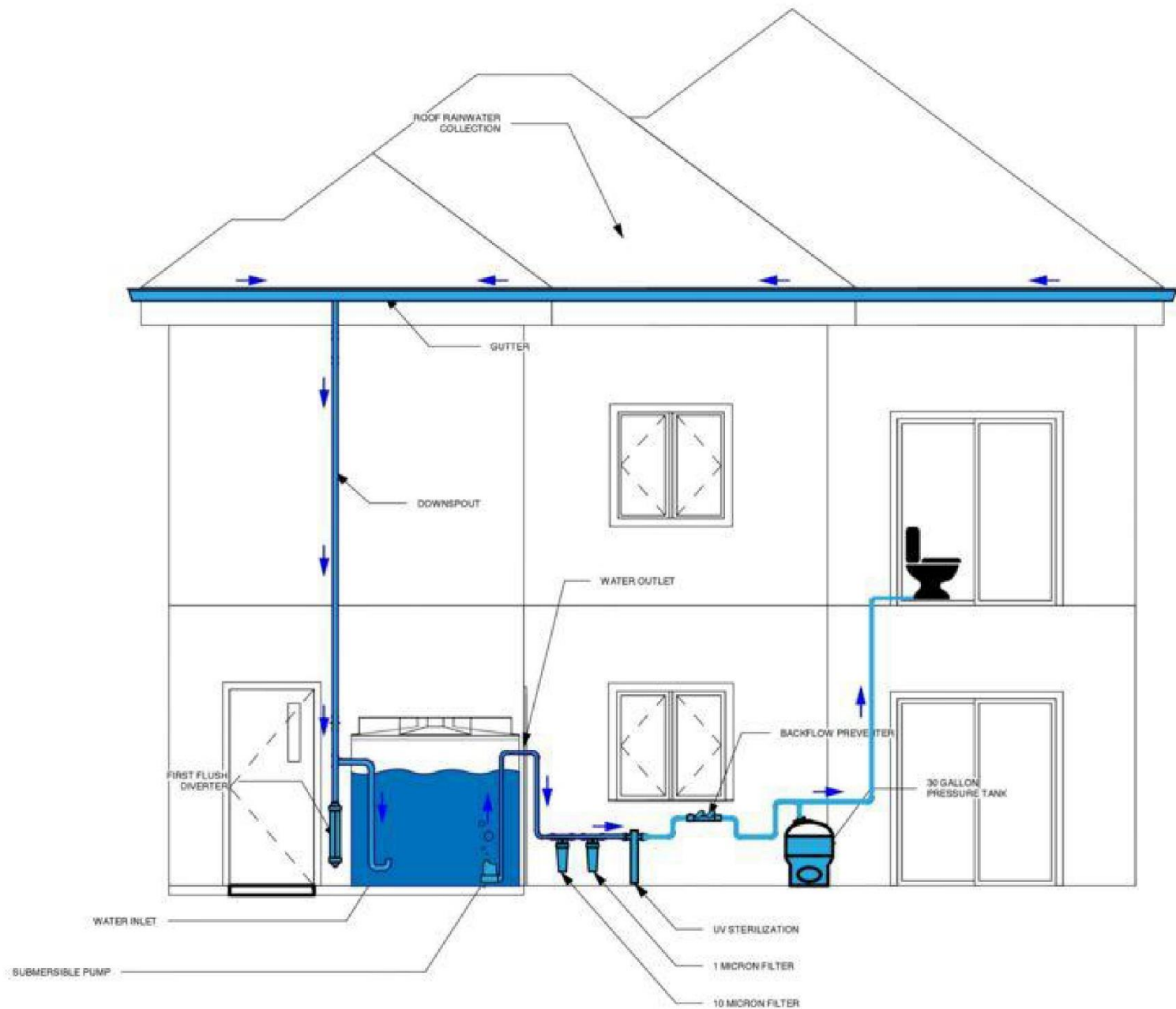




Legend

SYMBOL	ABBR	DESCRIPTION
	SD	STORM DRAIN
	SS	SANITARY SEWER
	RW	RAINWATER CONNECTION
	L	LAUNDRY
	IC	IRRIGATION CONTROLS
	DS	DOWNSPOUTS
		EXISTING TURF
		LANDSCAPE IRRIGATED WITH GW

Housing - Retrofitting Existing Buildings for Water Reuse





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Water Reuse Systems Introduction

This introductory report provides an overview of the different water reuse systems and typical costs, savings, and paybacks for each system as a rehab to multi-family residential housing in California in 2015.

Please see example site plans from the 2015 Eden Housing project conducted by Hyphae Design Laboratory at the following link: http://issuu.com/hyphaedesignlab/docs/4_site_plans/1. This project was the predecessor to this online tool and involved a water use and water reuse feasibility survey of more than one hundred Eden Housing multi-family affordable housing sites and the development of schematic site plans and costs for water systems at eleven of the sites. The site plans show the breadth of options and how different systems are applied and tailored to characteristics of different sites.

**Please view the report in full screen at 100% zoom.

[Water Reuse Systems Introduction](#)

Site Specific Report

How to Use This Report First please take the survey at the following link to enter information about your site: https://docs.google.com/forms/d/1CM66uFZoNzpzhq_dhl19-7xm3Dj3dYKhcMT8K4gi-SA/viewform.

After you complete the survey please return to this page and reload your browser. The newly generated report will take the information you enter into the survey and provide an overview of water use on your site and viable options and costs for water collection and reuse systems.

The intent is to provide an overview of water reuse options within existing legal parameters and to provide cost and water saving estimates that can inform budget and planning processes. This information can then be taken to a design-build contractor who can complete the design process and refine and develop the design with the unique and specific characteristics of your site.

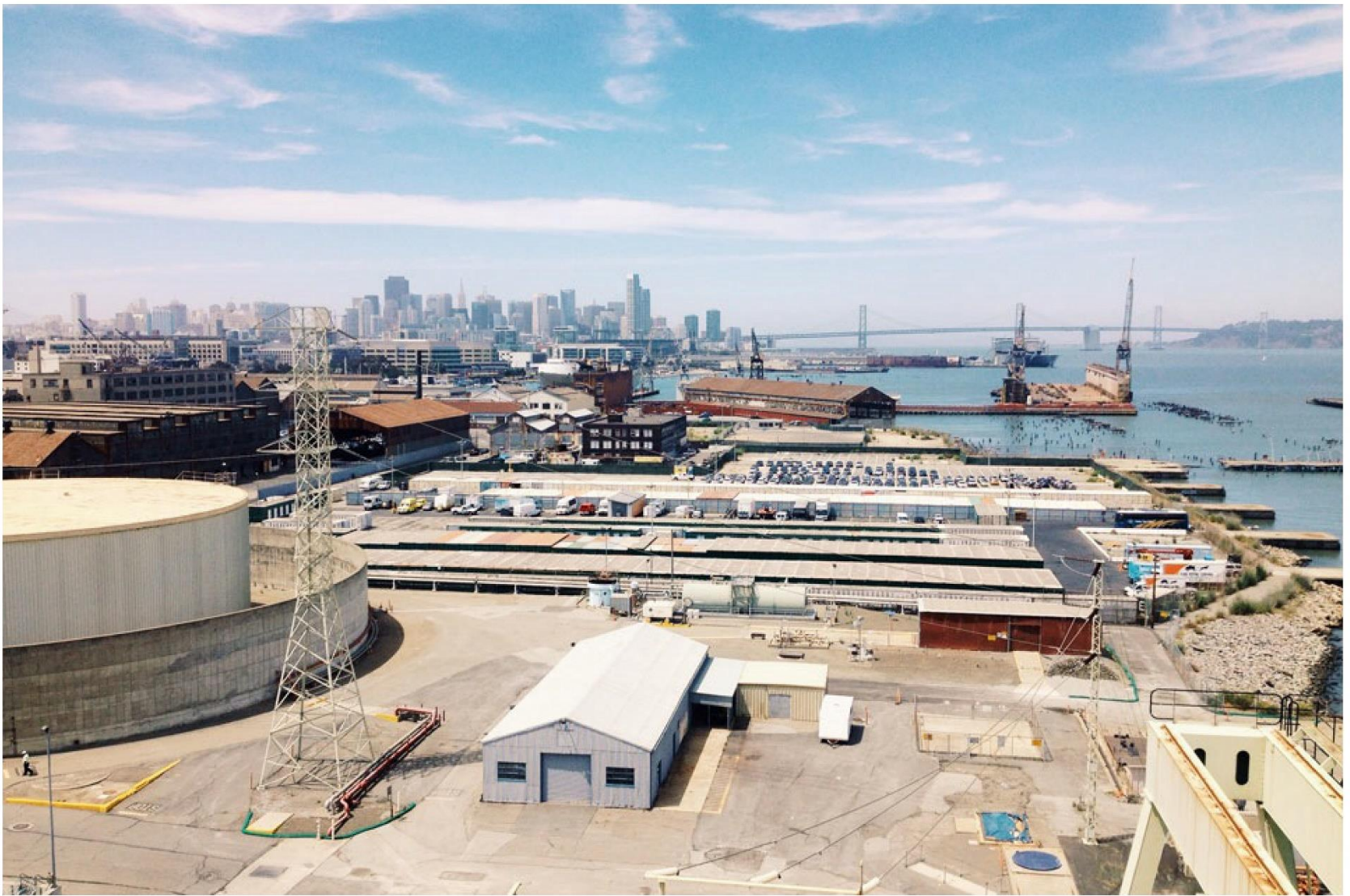
Information produced by this report is based on the survey you have filled out. The accuracy of the estimates in the report depend on the accuracy and completion of the survey data. If you have any questions about the report or tool please contact Hyphae Design Laboratory.

Limitations of the Report

Currently this report only calculates cost and water savings for seven water reuse systems constructed as rehab to existing multi-family residential properties in the State of California. Included systems are based on current (2015) legal and permitting conditions.

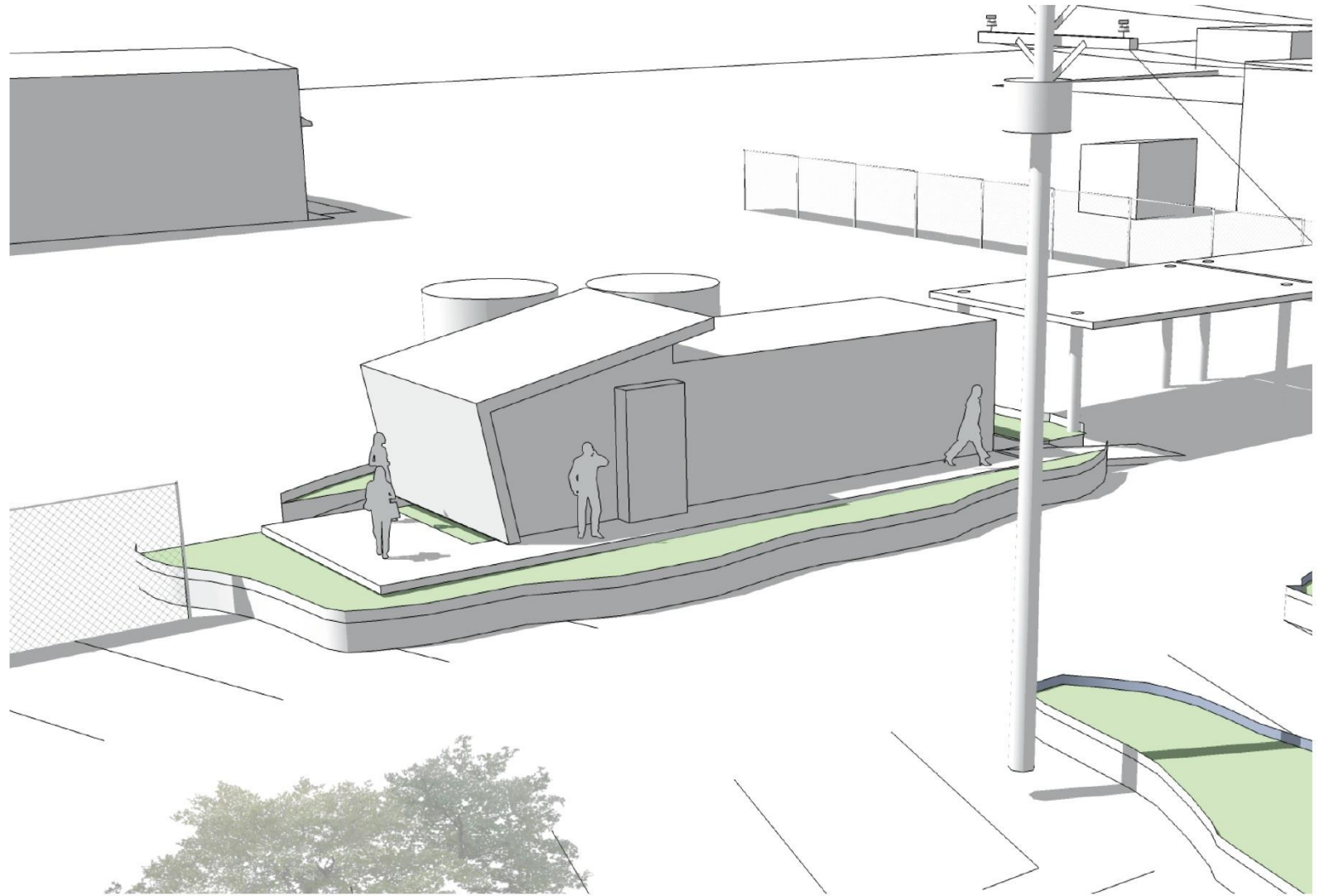
**Please view the report in full screen at 100% zoom.

[Site Specific Report](#)



Station A

Location | San Francisco, CA
Client | Private Energy Company
Architect | Vital



Station A

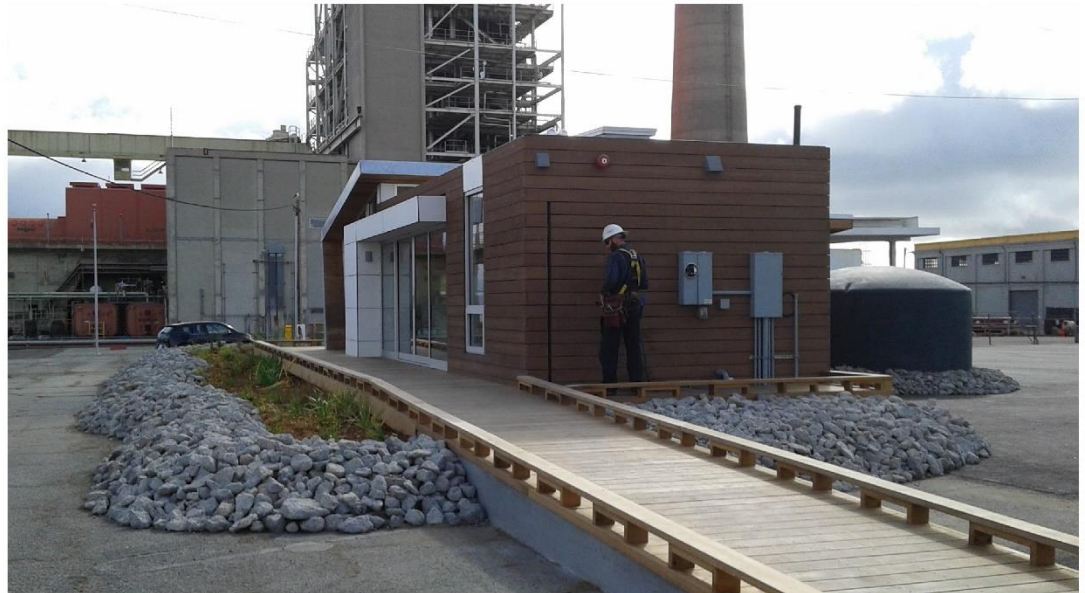
Location | San Francisco, CA
Client | Private Energy Company
Architect | Vital



Station A

Location | San Francisco, CA
Client | Private Energy Company
Architect | Vital





Station A

Location | San Francisco, CA
Client | Private Energy Company
Architect | Vital

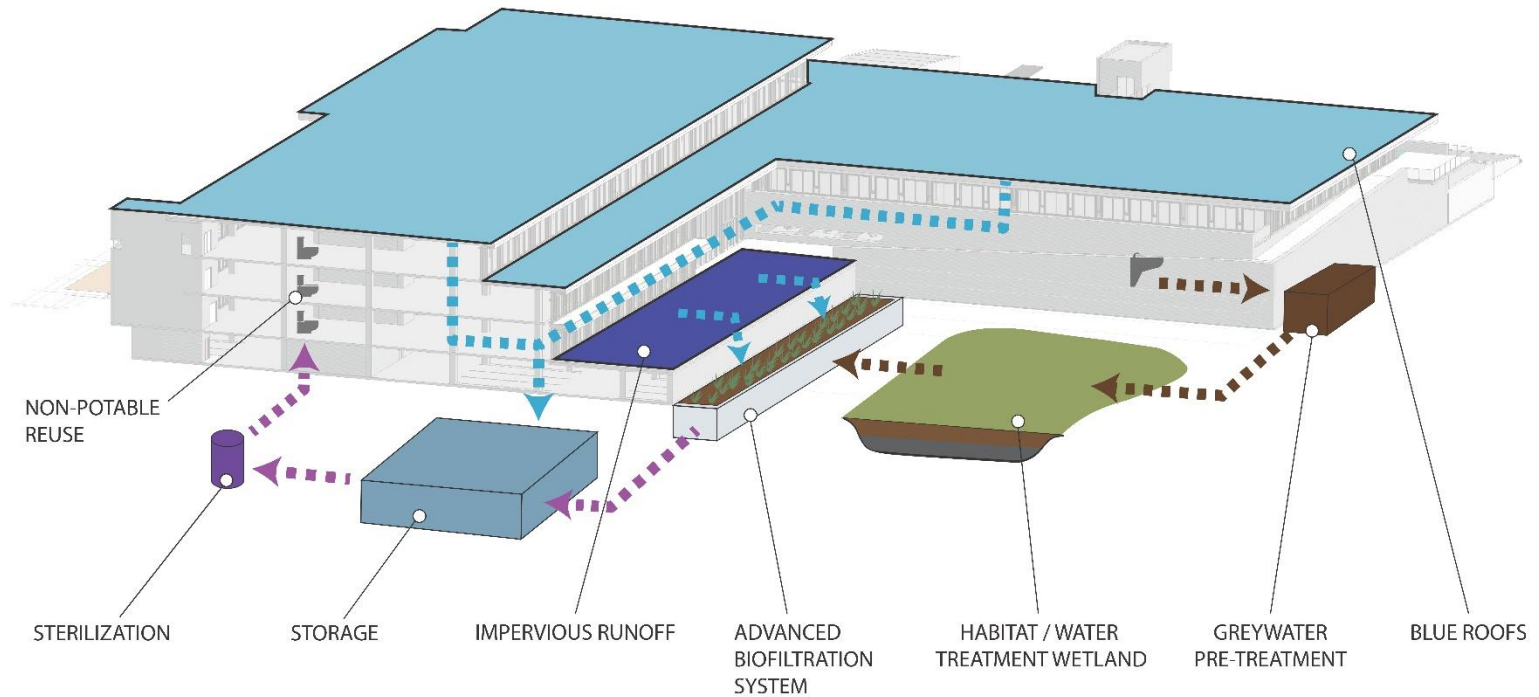


Wetland Office

Location | Mountain View

Client | REES Properties

Architect | WRNS



Filtered water will be stored for at least 2-3 weeks of use and treated with ozone to maintain water quality.

Before any water is pumped to the building, it will then receive UV, charcoal and microfiltration. [Water quality will meet or exceed State ||Water Board Title 22 nonpotable standards.

The roofs, wetlands, tanks and irrigation will be managed dynamically, as an integrated system, based on building reuse needs and predictive weather analysis.

As irrigation and building demands increase or storms are predicted, treated water will be released from the wetlands, through the biofilter and into the tank for short term storage, sterilization and reuse.

Site hardscape runoff from plazas and parking surfaces will flow through lined biofiltration planters and into the tank or wetlands depending on flow volumes.

Conventional bioswales retain water, but often have increased turbidity and nutrient levels due to the growing media, and more advanced medias provide higher treatment for reuse

Stormwater and treated greywater will passively flow into a sand lined biofiltration system before entering the tank. Slow sand filters and slow movement provides highly effective biological and mechanical filtration, used throughout the world, to improve both drinking water and wastewater quality.

Each molecule of water flows through the wetland for at least 7 days before reuse. During this time suspended solids will settle, natural aeration from the plants will reduce BOD, microbial filtration will consume organic matter and remove nitrogen.

The water treatment wetlands will also provide a significant habitat value and unique ecosystem, which will be wet, year round; an oasis for migratory birds and other species.

Anaerobic and aerobic treatment tanks provide primary filtration before greywater is distributed to the wetlands.

In the event of abnormal heavy rains, greywater can be redirected to sewer, allowing even more stormwater management in the site wetlands.

The project is looking to incorporate an innovative technology called "blue roofs" which actually hold from 1-4" of rainwater on the roof during large storm events, provide additional storage capacity, cool the roofs, and then slowly release water to site storage.

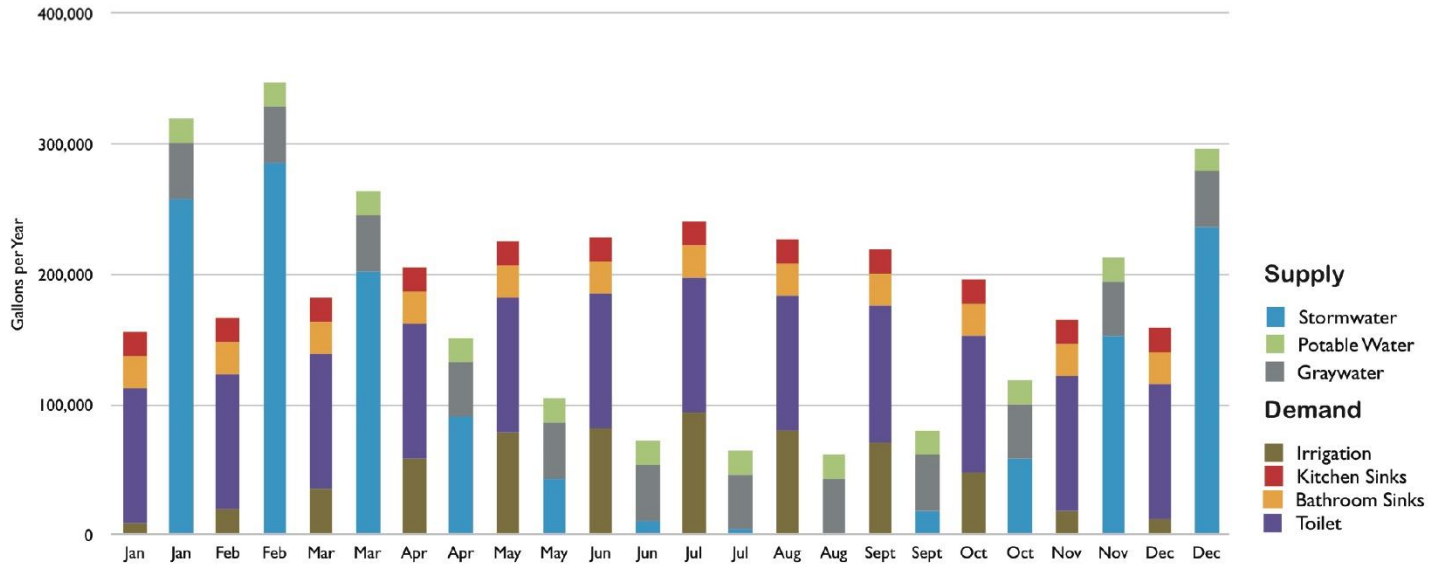
Wetland Office

Location | Mountain View

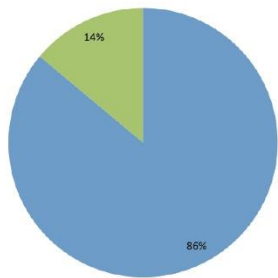
Client | REES Properties

Architect | WRNS

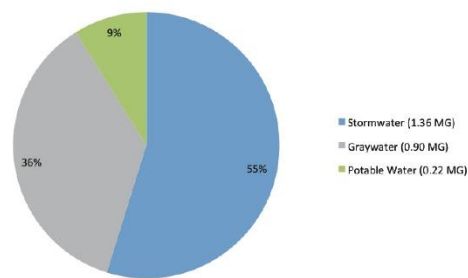
Water Supply & Demand Calculations



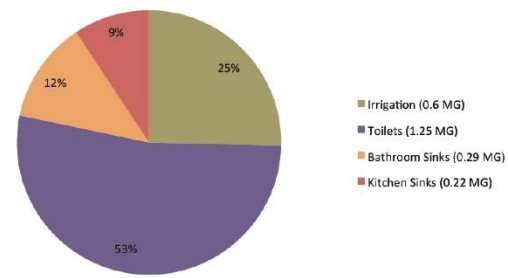
Total Water Supply to Site (per year)



Water Supply to Demands Including Reuse (per year)



Water Demands (per year)

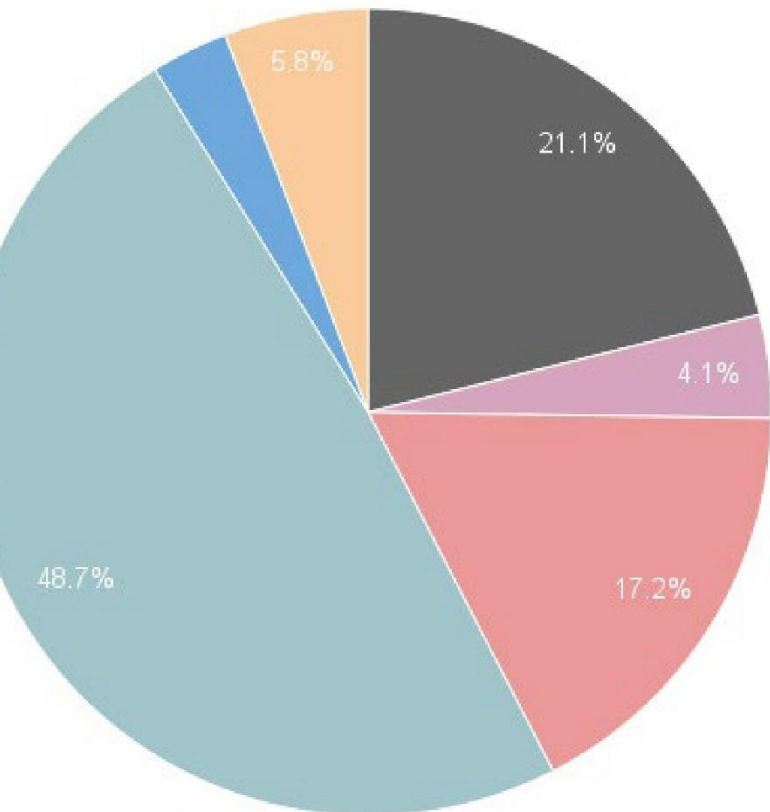


Wetland Office

Location | Mountain View

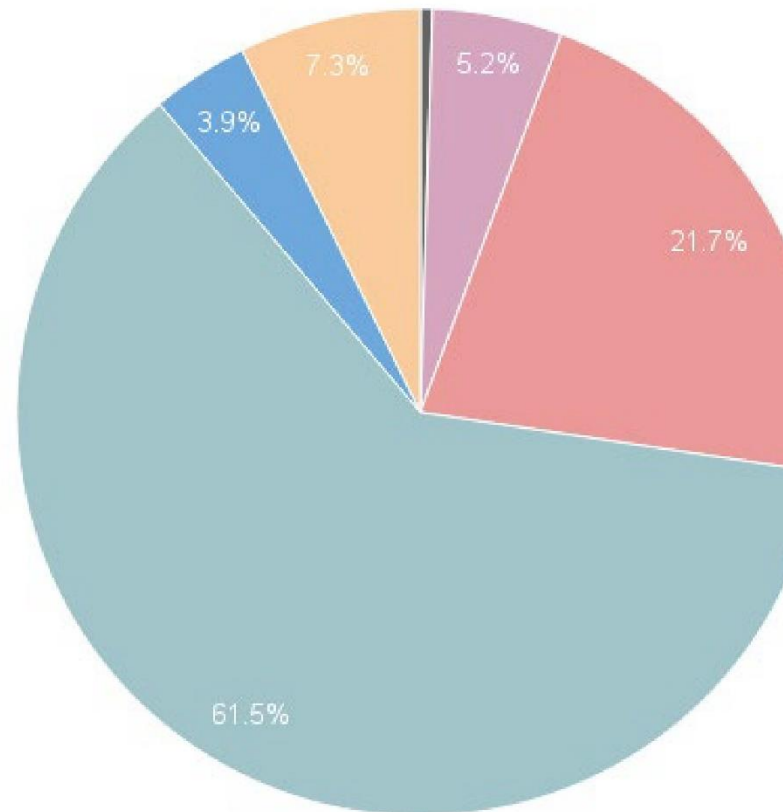
Client | REES Properties

Architect | WRNS



Low - Flush Toilets

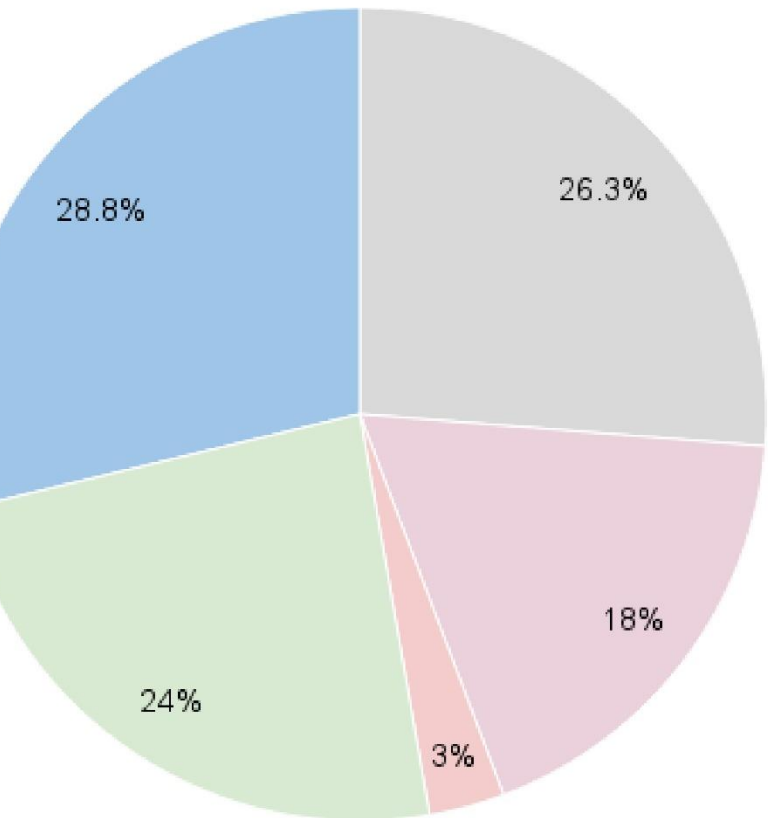
- Toilets
- Bathroom Sink
- Kitchen Sink
- Showers
- Drinking water
- Laundry



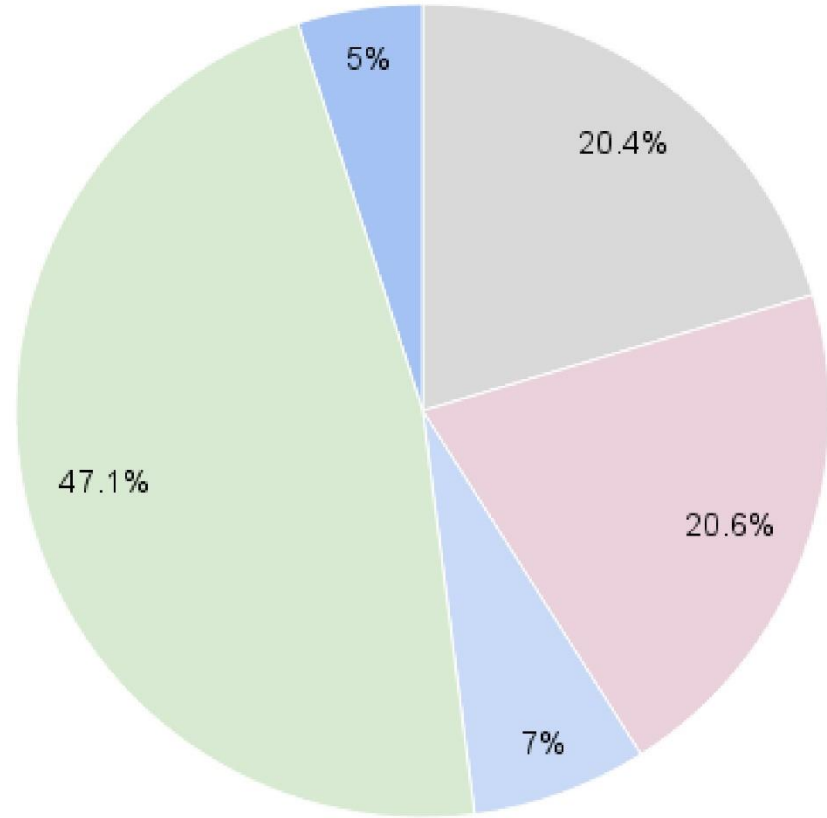
Composting Toilets

Assumptions		
Building Occupants	167	
Fixture	Daily use per resident	Water per Use (gallons)
Toilet	4.00	1.28
Bathroom Sink	6.00	0.17
Kitchen Sink	1.67	1.50
Shower	0.75	15.75
Drinking Water	1.00	0.75
Laundry	0.13	12.00





LBC Estimate



Hyphae Estimate

Assumptions: Pre-Capita Water Use		
Gallons / Capita / Day	Hyphae	Living Building Challenge 3
Toilet	5.12	5.25
Faucets	5.17	3.60
Dishwasher	0.00	0.60
Showers & Bath	11.81	4.80
Laundry	1.4	5.75
Drinking Water	1.75	0
Total	25.25	20.00

- Toilets
- Faucets
- Dishwater
- Showers & Bath
- Laundry

!! Interesting -- Compliance with future scenario item 3 would mean a completely different plumbing system. Seems that you can't sensibly comply with requirements for items 1-3 and still design for the future with the same plumbing design.

SUPPLY AND GREY WATER TREATMENT



3 ILFI AFFORDABLE HOUSING FRAMEWORK - FUTURE SCENARIO



In order to source 100% of the building's water in the future, we would need to use rainwater for sinks and drinking water, recycle building graywater for laundry, showers, and toilets if flush toilets are used.

45,000 gallon tank would be needed to offset 100% of sink demand

78 % of building water demand offset - low flush toilets

100% of building water demand offset - composting toilets

In order to meet 100% future demand offset, the building needs to have composting toilets



Power = Water

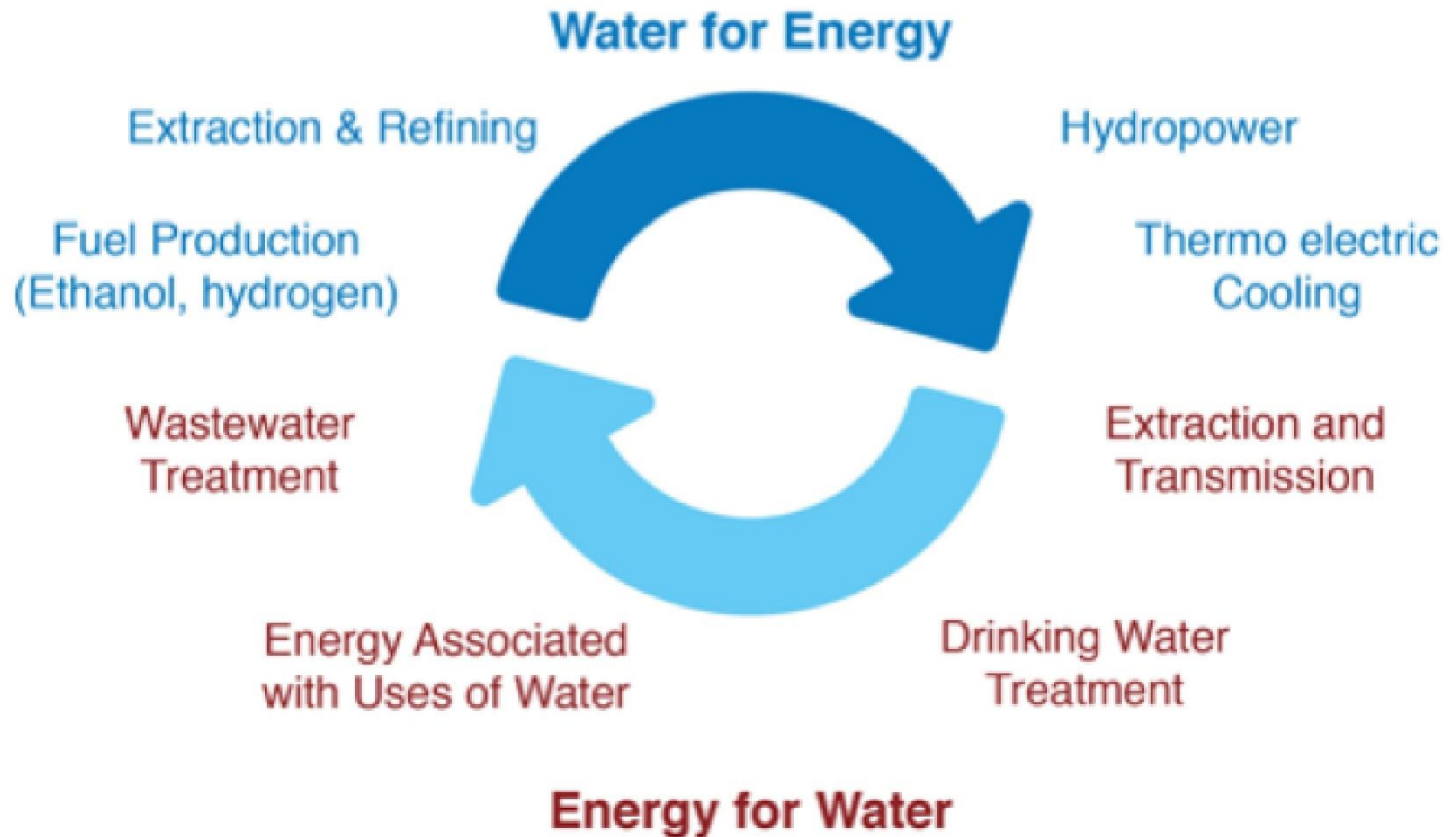
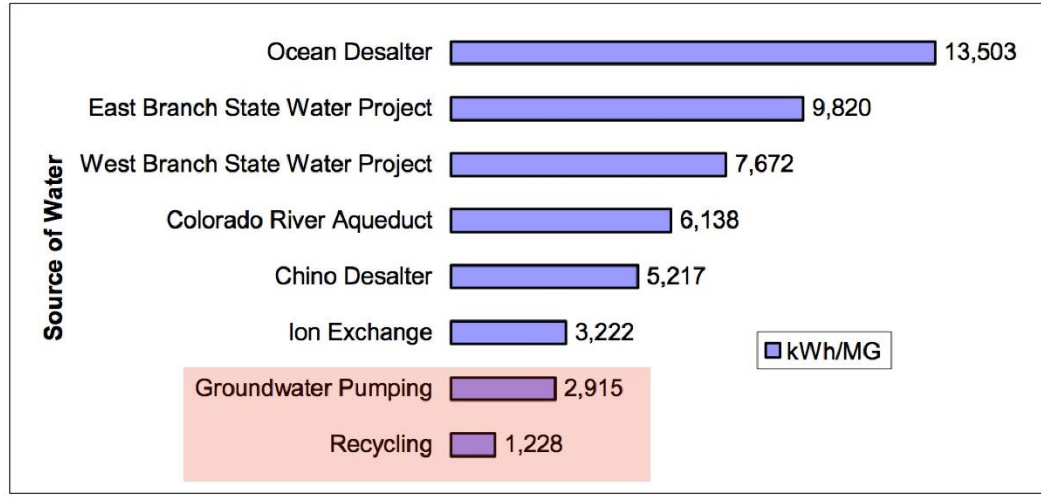
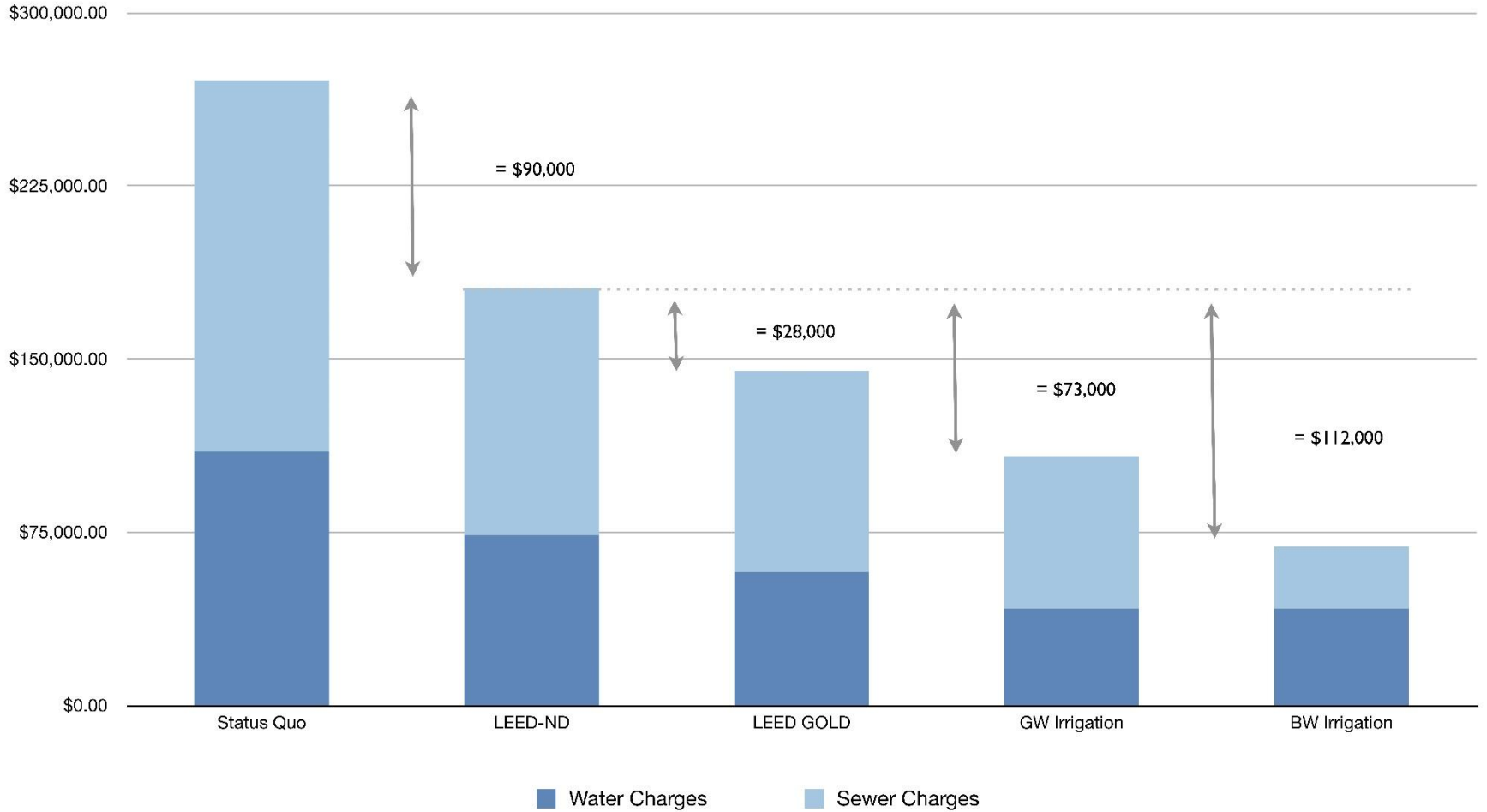


Figure 2-2 Energy Intensity of IEUA Water Supply Options



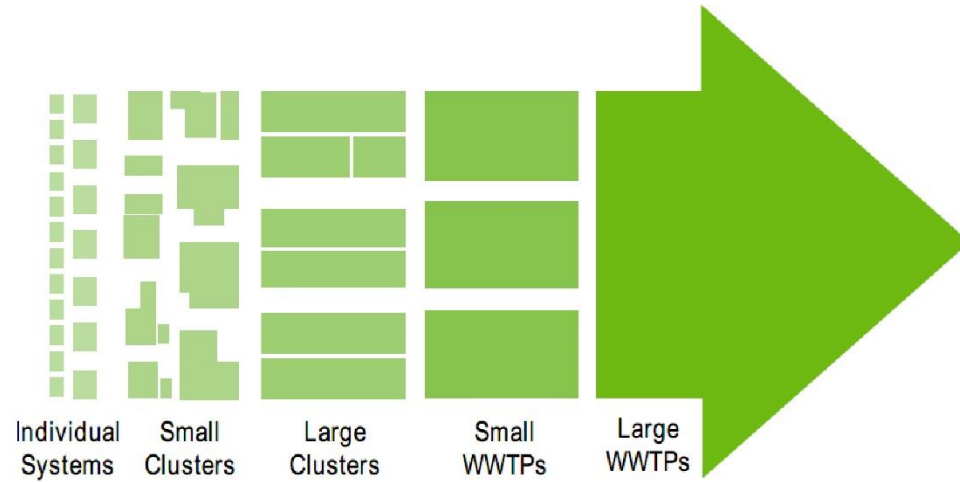
Source: Dr. Robert Wilkinson, Environmental Studies Program, University of California, Santa Barbara, and Martha Davis, IEUA.

Estimated Water and Sewer Costs

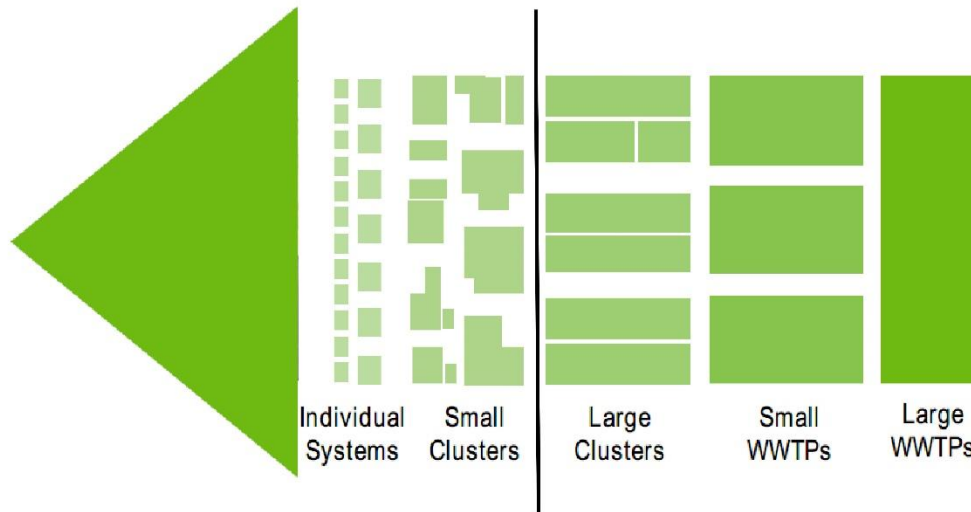


A New Paradigm in Water Use

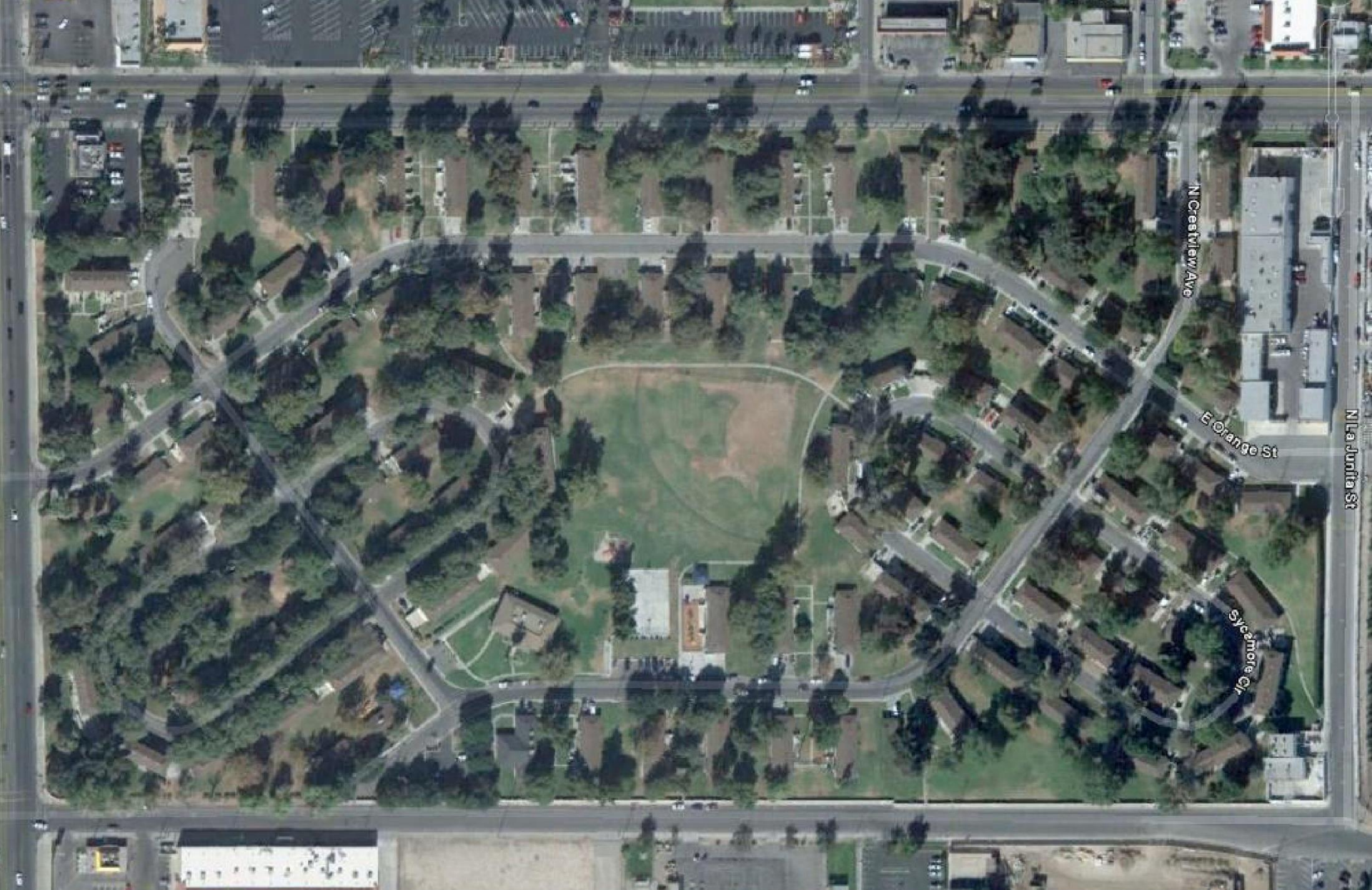
20th Century



21st Century



WATERMAN



N Crestview Ave

E Orange St

N La Junta St

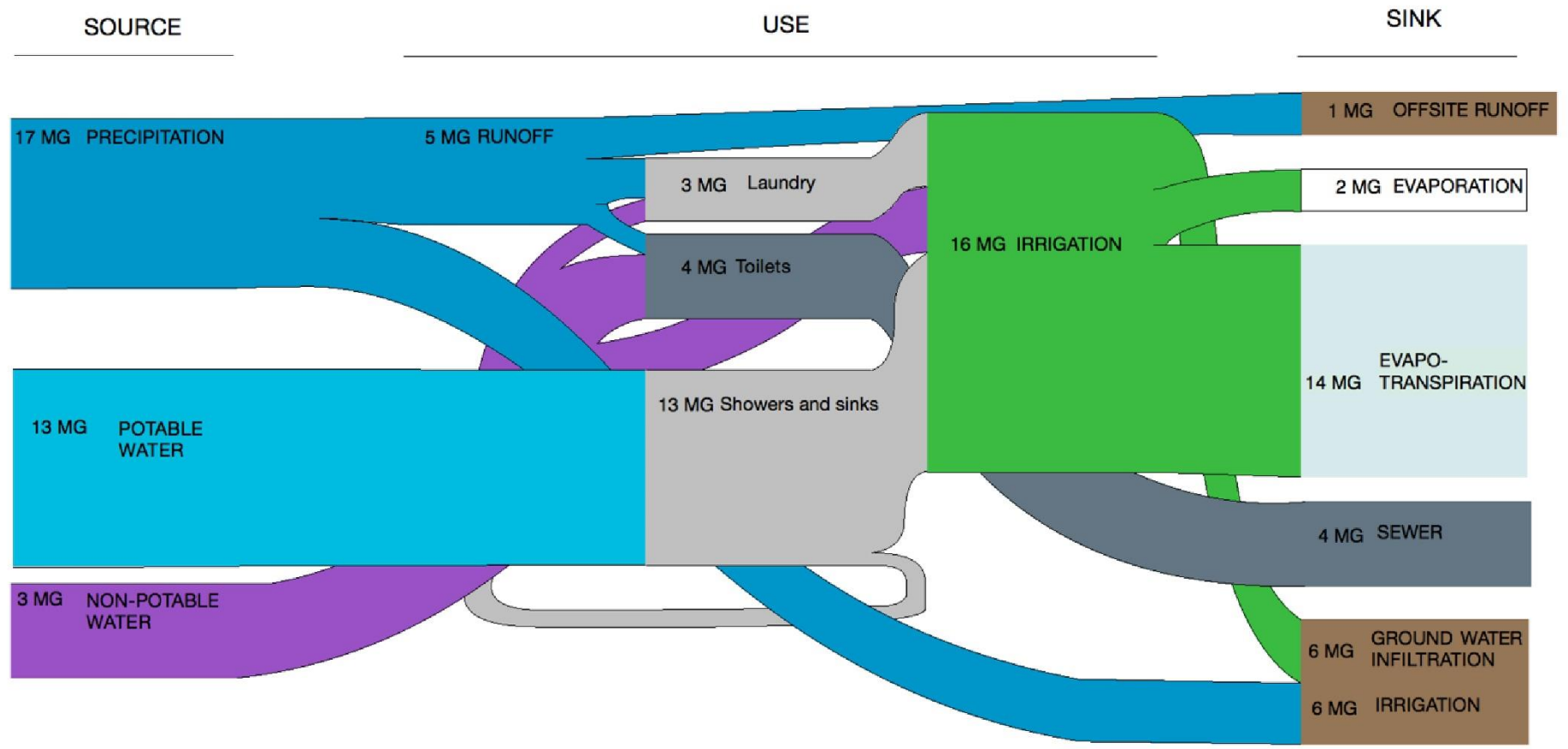
Sycamore Cir

WATERMAN GARDENS



Hypae recently completed the Masterplanning and Entitlement phases for the conversion of this Army Base in San Bernardino into a 400 unit LEED Platinum affordable housing development for the Housing Authority. We served as Design Engineer, and sustainability consultant. The following 4 pages include some of our work on the project

IWM: 1400 HOME COMMUNITY



THE BIG #'s

Average Annual Rainfall (in)	16.08
Total Annual Stormwater Runoff (million gallons)	8.2
Total Annual Graywater Production (million gallons)	20
Total Annual Toilet Demand (million gallons)	4.4
Total Annual Irrigation Demand (million gallons)	28

