WATEREUSE
LOS ANGELES
ORANGE COUNTY

WateReuse Summit
Los Angeles and Orange County

Ripple Effect: Recycle, Recharge, Repeat!

October 8, 2024

WATEREUSE
LOS ANGELES
ORANGE COUNTY

Jared Lee and Scott Lynch

WateReuse Los Angeles Chapter President and Orange County Chapter Presidents

WateReuse Summit
Los Angeles and Orange County
Ripple Effect: Recycle, Recharge, Repeat!

WateReuse Summit
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Thank you to our Sponsors!

Brenley McKenna

WateReuse California Managing Director

WateReuse Summit
Los Angeles and Orange County
Ripple Effect: Recycle, Recharge, Repeat!

Tai Tseng

Long Beach Utilities Assistant General Manager

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Lunch (Veranda Dining Area, Pre-registration Required) ..... 11:00 a.m.

Welcomes and Introductions (Auditorium) ..... 12:00 p.m.

12:00 - 12:05 pm: Welcome from LA & OC Presidents, Jared Lee and Scott Lynch

12:05 - 12:20 pm: Opening Remarks from Brenley McKenna, WateReuse CA Managing Director

12:20 - 12:30 pm: Welcome from Tai Tseng, Long Beach Utilities Assistant General Manager

Sponsor Presentations (Auditorium) ..... 12:30 p.m.

12:30 – 12:50 pm: A Ripple Through Time: WRD's 60 Years of Recycled Water Programs and Beyond (*Everett Ferguson, Senior Hydrogeologist, Water Replenishment District*)

12:50 - 1:10 pm: A Multi-faceted Approach to Managing Water Reuse Programs (*Julie L Labonte, PE, Global Program Management Director – Water, and Jacquelin Mutter, MBA, One Water Planning Lead, HDR*)

1:10 - 1:30 pm: Singing Your Praises: The Ripple Effect of Storytelling (*Katie Evans, Senior Communications Strategist, Woodard & Curran*)

Break ..... 1:30 p.m.

Sponsor Presentations (Auditorium) ..... 2:00 p.m.

2:00 - 2:20 pm: Optimizing Water Reuse: Effective Management of IPR and DPR Operations (*Nathan Boyle, Water Reuse Practice Leader -West, Hazen and Sawyer*)

2:20 - 2:40 pm: Transforming Southern California's Water Future (*Surendra Thakral, PE, BCEE Vice President and Chelsea Jiang, PE Project Engineer, AECOM*)

2:40 - 3:00 pm: Back from the Dead, City of LA's Groundwater Replenishment Project (*Jesus Gonzales, Manager of Groundwater and Recycled Water, Los Angeles Department of Water and Power*)

Adjournment ..... 3:00 p.m.

Aquarium Tour (Pre-Registration and Closed-Toed Shoes Required) ..... 3:15 p.m.

WATEREUSE®

2025 SYMPOSIUM

Celebrating 40 Years

MARCH 16-19

JW MARRIOTT TAMPA
WATER STREET

TURNING *the* TIDE TOWARD WATER REUSE

IN COLLABORATION WITH
THE WATER RESEARCH FOUNDATION

SAVE BIG UNTIL 10/15!

WRD
WATER REPLENISHMENT DISTRICT

Los Angeles & Orange County
WateReuse Summit – October 2024

A Ripple Through Time

WRD's 60 Years of Recycled Water Programs and Beyond

SECURING OUR WATER FUTURE TODAY

Los Angeles County would not exist as it does today without supplemental water

WRD is a groundwater management agency that oversees groundwater replenishment with local and supplemental water

- 43 Cities in Southern L.A. County
- 420 Square Miles
- 4 Million People
- Over 10% of California's Population
- Second Largest Water District by Population in California
- Groundwater Makes up Nearly 50% of the Region's Water Demand
- 450,000 Acre-Feet (150 Billion Gallons) of Useable Groundwater Storage

HISTORY OF RECYCLED WATER

1930

WRD Service area population - 590,000.

1938-39

Rio Hondo Coastal Spreading Grounds built by LACDPW.

L.A. River concrete channelization begins at the expense of groundwater recharge.

San Gabriel Coastal Spreading Grounds built by LACDPW.

1940

WRD Service area population - 1,017,000.

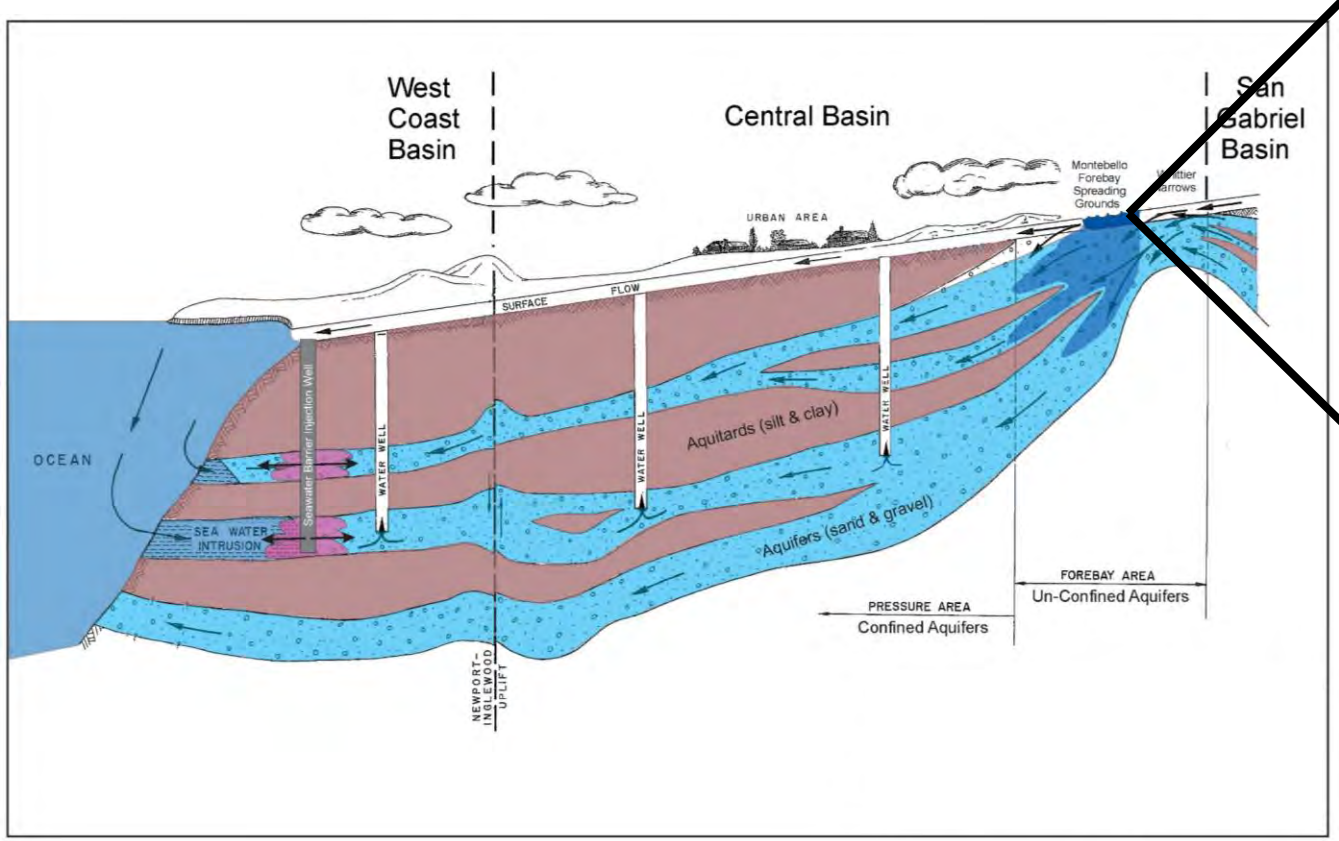
1949

Landmark Study "The Reclamation of Water form Sewage and Industrial Waste" was completed

1950

WRD Service area population ~2,000,000.

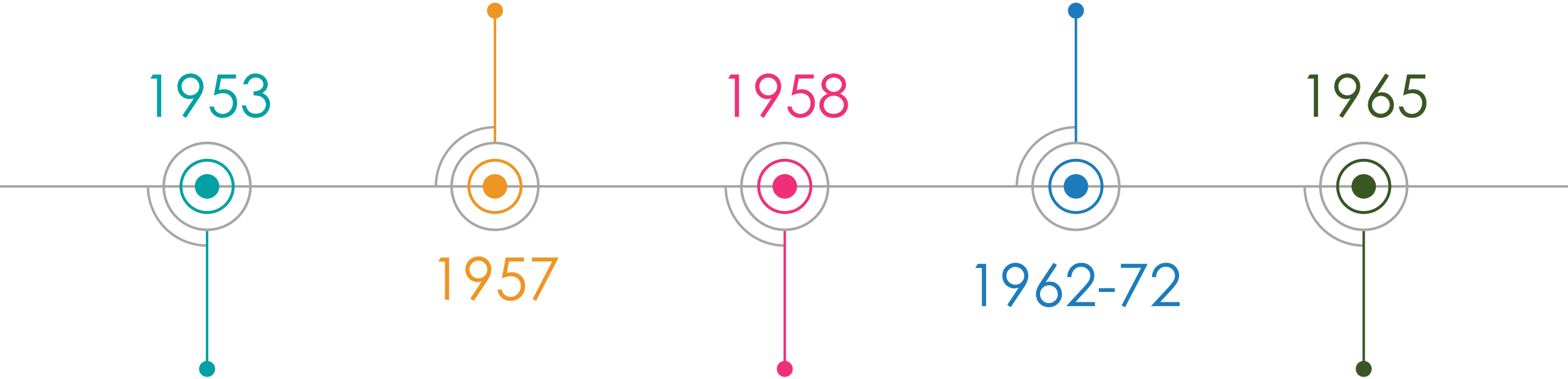
The LA County Spreading Grounds allowed for groundwater replenishment



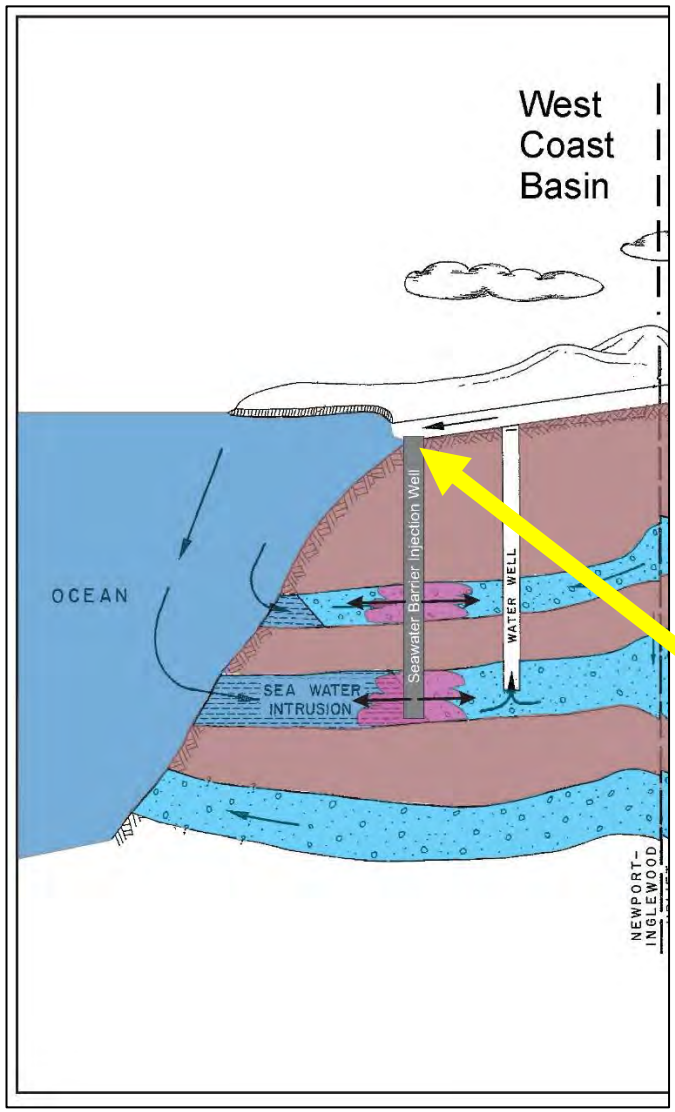
Public Works
LOS ANGELES COUNTY

San Gabriel River and Rio Hondo Spreading Grounds

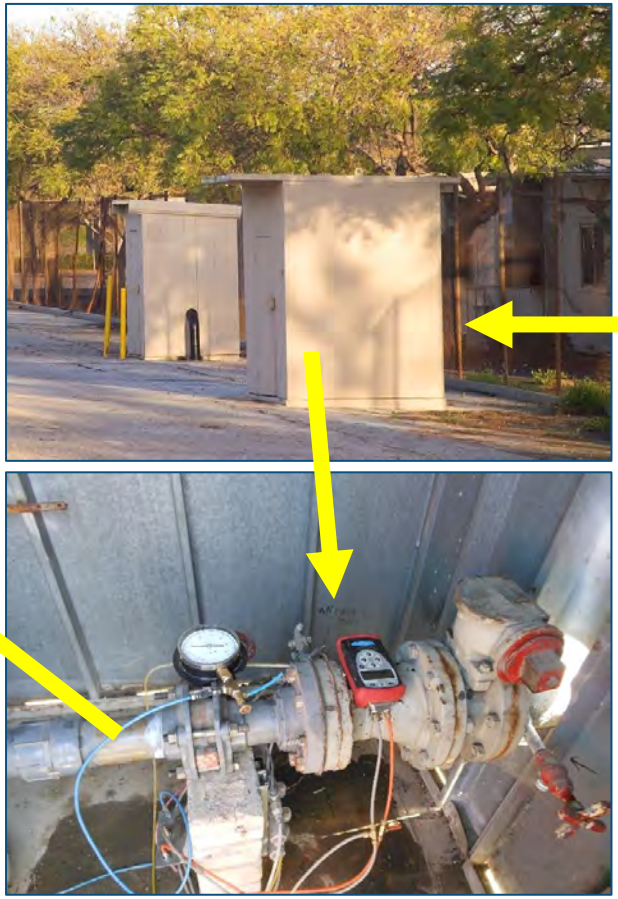
HISTORY OF RECYCLED WATER



The LA County Seawater Barrier Injection Wells protect against seawater intrusion



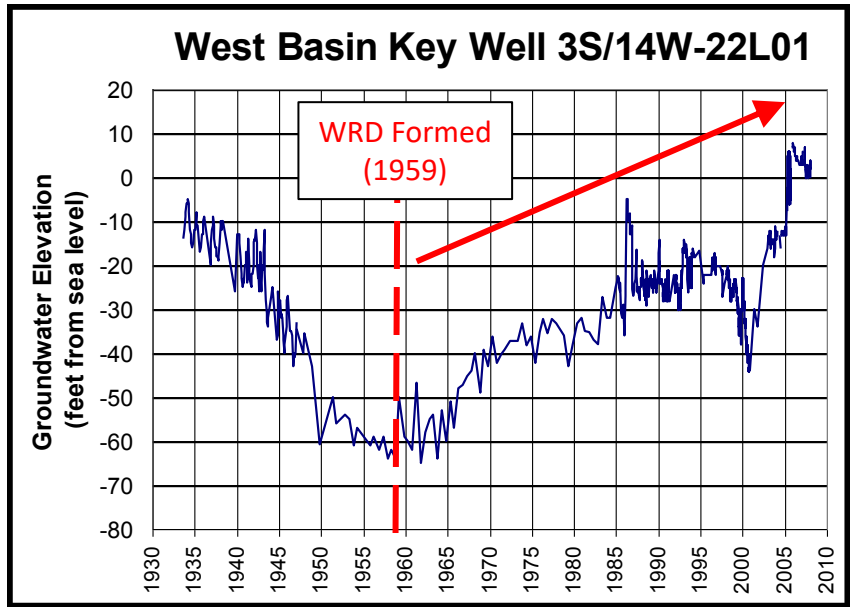
Freshwater Injection Wells

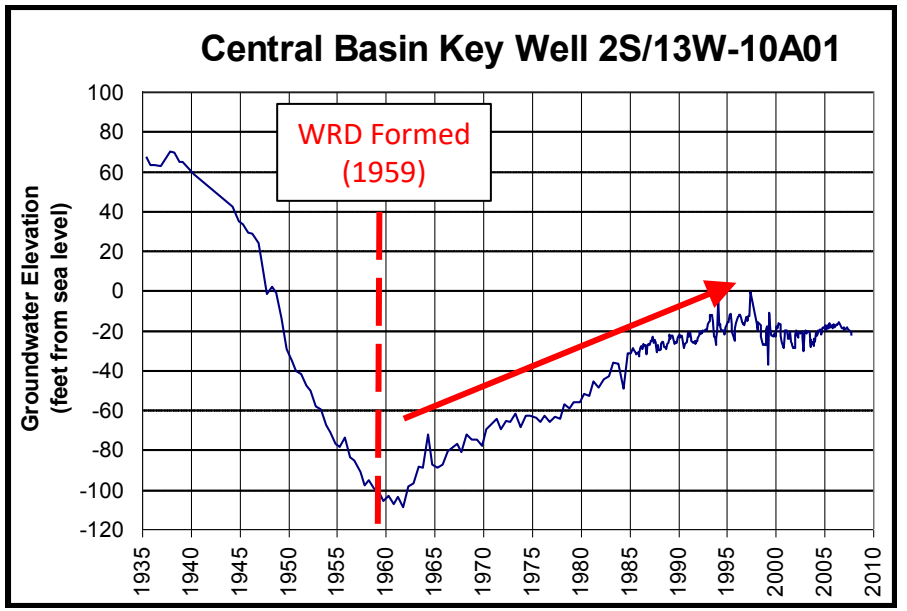


Public Works
LOS ANGELES COUNTY

Since WRD's formation, basin management has improved significantly

Groundwater Elevations 1930-2010





HISTORY OF RECYCLED WATER

1972

WRD filed a permit application with the RWQCB for direct injection of treated water; but in 1974, due to the increased costs needed to satisfy the CA-DHS, negotiations between WRD and LADWP ended.

1995-2006

Three Advanced Water Treatment Facilities are built and send water to the Seawater Barrier Injection Wells (50% limit). Edward C. Little WRF, WRD Leo J. Vander Lans AWTF, LASAN TITP.

2014

RWQCB increased MFSG RW contribution limit from 35% to 45% and increased the averaging period to 10 years.

2015-16

RW % increased to 100% ATW for all Seawater Barrier Injection Wells.

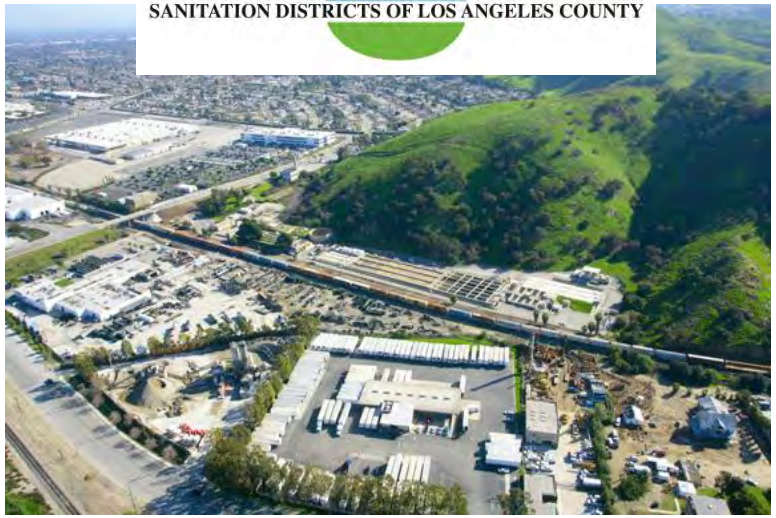
2019

ARC AWTF formally opened producing 10,000 AFY of AWT and WRD WIN Program complete.

Three Water Reclamation Plants were built and sent water to the spreading grounds (1962 – 1972)

Whittier Narrows WRP

SANITATION DISTRICTS OF LOS ANGELES COUNTY



Pomona WRP

San Jose Creek WRP

Public Works
LOS ANGELES COUNTY

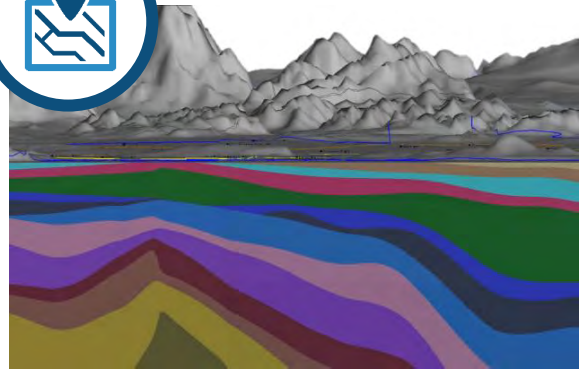
WRD manages the basins through multiple roles

Replenishment

Monitoring

Cleanup

Water Recycling



Basin Modeling

Regional Watermaster

Three Advanced Water Treatment Facilities were built and sent water to the seawater barriers (1995 – 2006)

West Basin MWD
Edward C. Little WRF - 1995

West Coast Seawater Barrier Injection Wells

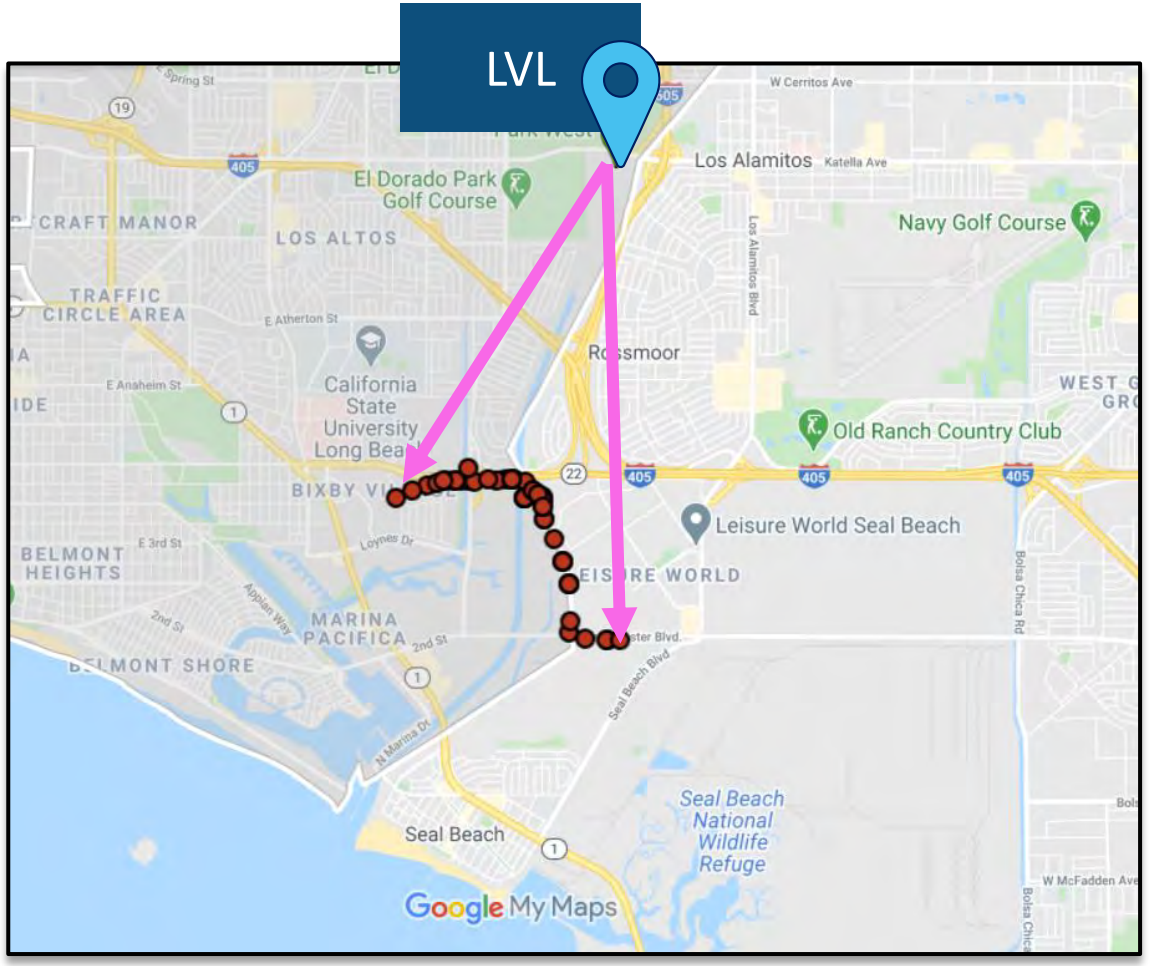
Water Replenishment District
Leo J. Vander Lans AWTF - 2005

Alamitos Gap Seawater Barrier Injection Wells

City of Los Angeles
Terminal Island AWPF - 2006

Dominguez Gap Seawater Barrier Injection Wells

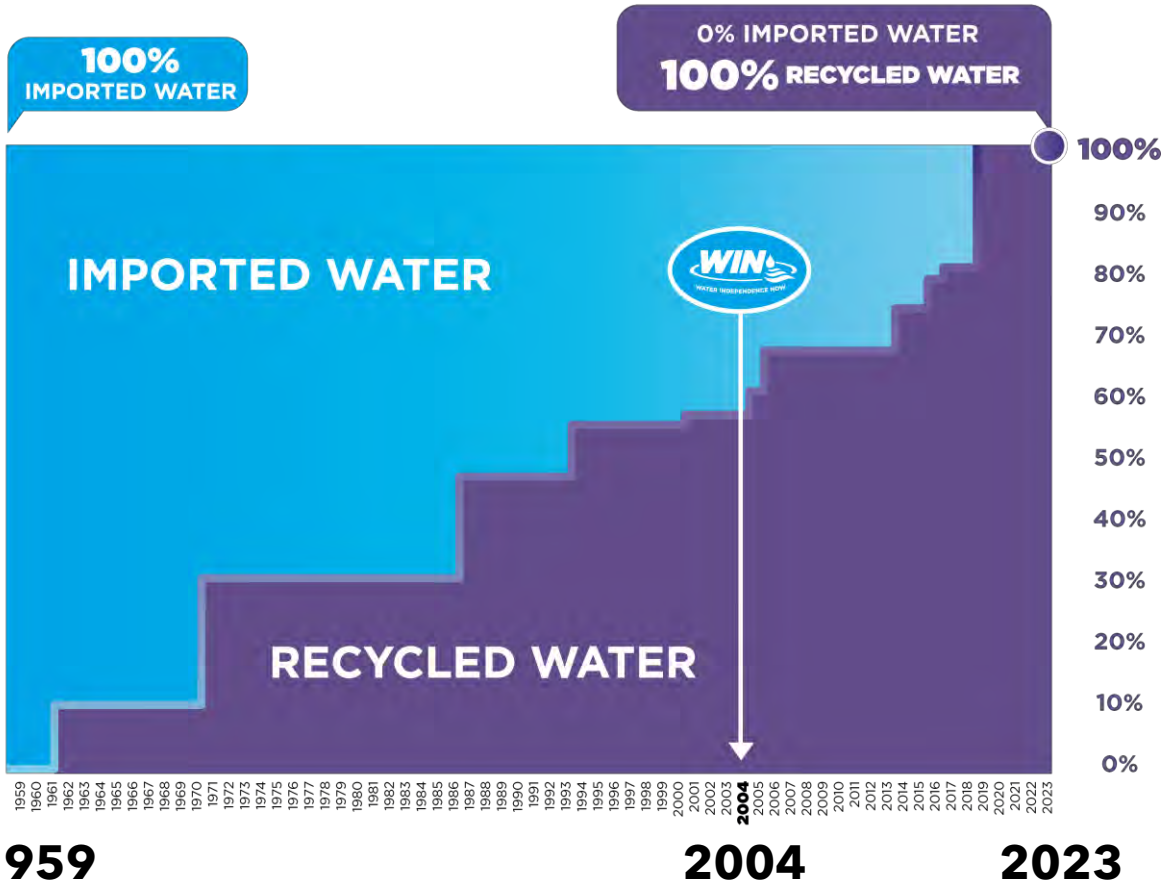
For example, water from WRD's LVL is sent to the Alamitos Barrier



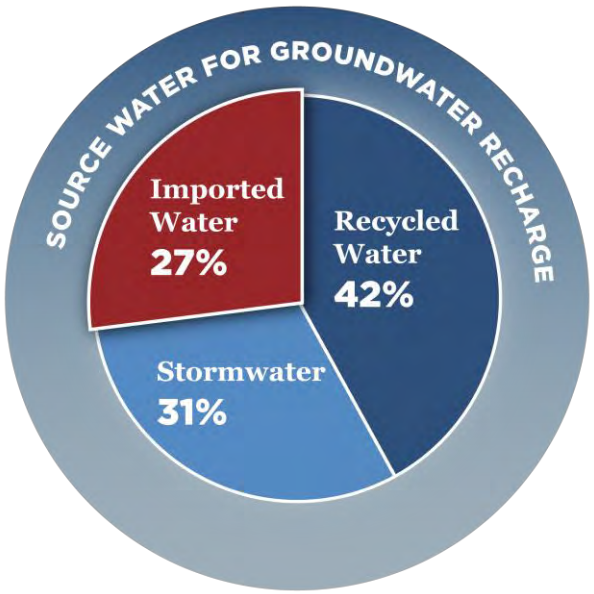
WRD completed its Water Independence Now Program (WIN) in 2019

WATER INDEPENDENCE NOW

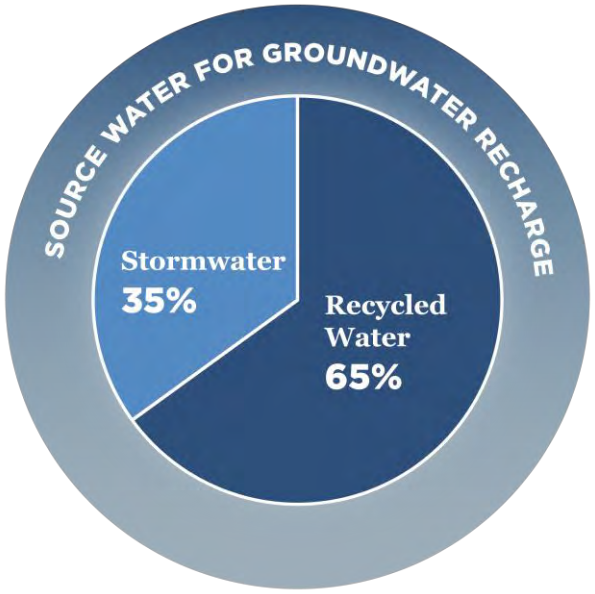
Collection of projects that offset the demand for imported water to replenish the Montebello Forebay groundwater aquifers.



BEFORE WIN



AFTER WIN



ARC is the capstone project for the WIN Program

Albert Robles Center for Water Recycling & Environmental Learning

- Max. Plant Capacity: 14.8 MGD
- Plant Recovery Goal: 91.9%
- Min. Annual Production: 10,000 AFY

SYSTEM WATER CONVEYANCE

Montebello Forebay Spreading Grounds

SJCWRP

Tertiary RW Pipeline

ARC operates under 2 permits:

1. **WDR/WRR Permit** – Discharges to spreading grounds
2. **NPDES Permit** – Discharges to San Gabriel River

Project Need: Montebello Forebay Replenishment Sources

1. **Stormwater Capture**
   Averaging 54,000 AFY; prone to drought cycles

2. **Recycled Water Contribution Limit: 45%**
   Tertiary recycled water for recharge is limited per the permit (45% over 10 years)

3. **Total Organic Carbon (TOC_{max}) for Recharge Water**
   TOC_{max} decreases (becomes more stringent) as tertiary recycled water recharge increases

4. **ARC Product Water considered "Null" Water**
   Null water is not considered/added to the Recycled Water Contribution calculation, therefore ARC product water has no limit for recharge (unlike tertiary recycled water)

HISTORY OF RECYCLED WATER

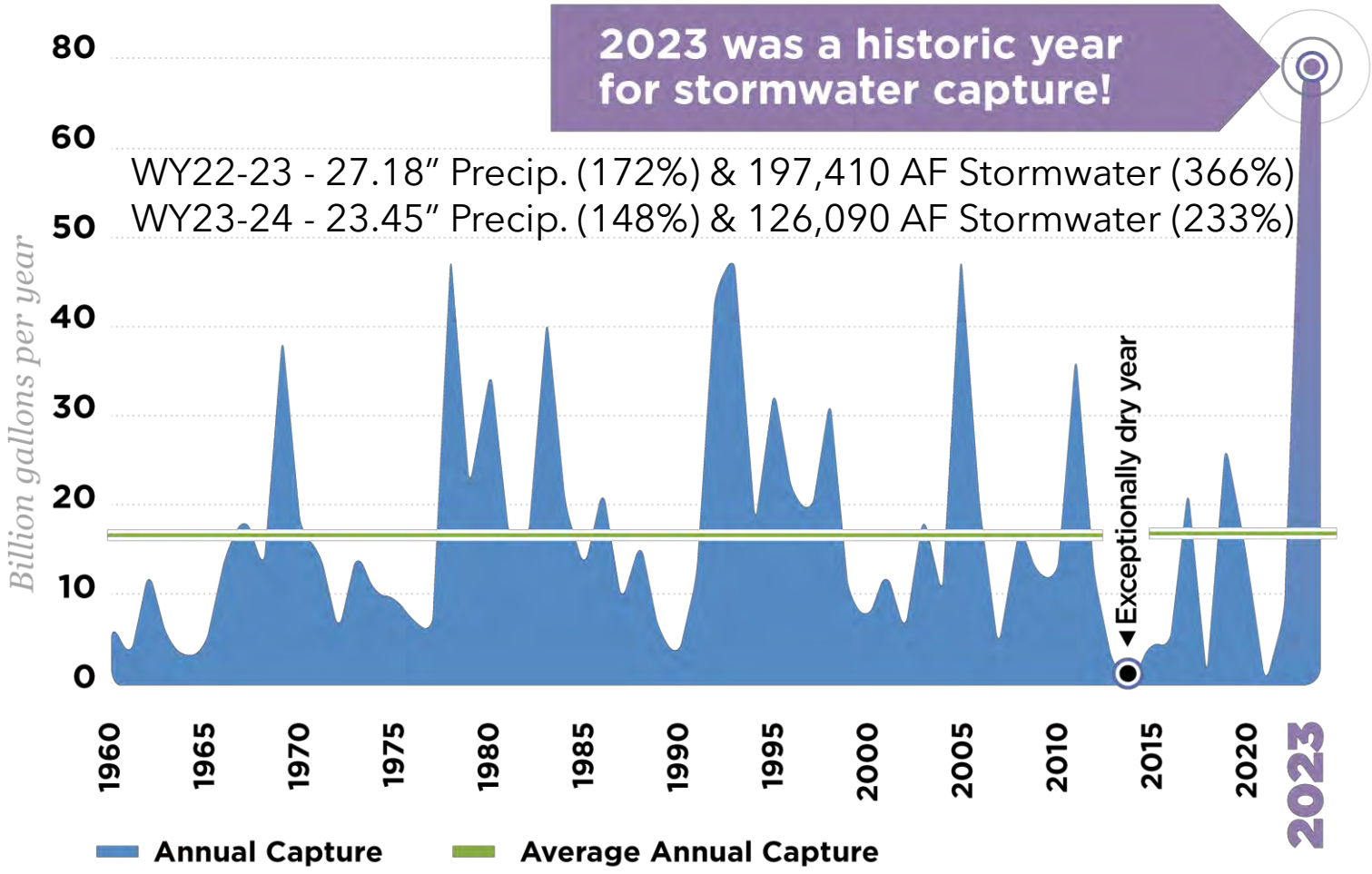
What's Next?

WIN 4 ALL

THE 2040 PLAN FOR REGIONAL WATER INDEPENDENCE

WRD Board adopts the WIN 4 ALL Program

WRD needs to be ready for extremes of wet and dry years

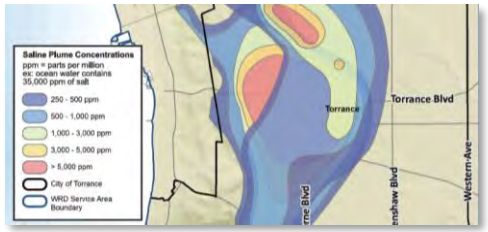


Historic precipitation in 2023 – 2024 filled the spreading grounds to capacity for months

WIN 4 ALL will ease the strain on imported water supplies and provide resiliency for dry years

Unused Local Water Supplies

Stormwater

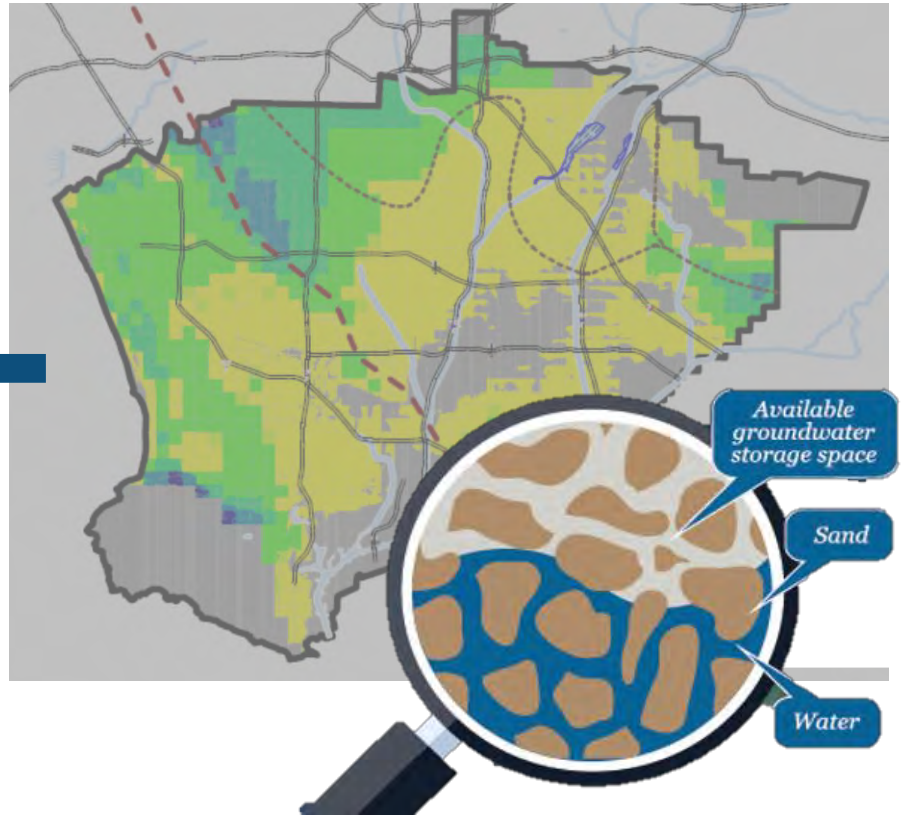


Contaminated GW

Recycled Water

+

Available Groundwater Storage Space



450,000 acre-feet
(150 billion gallons)

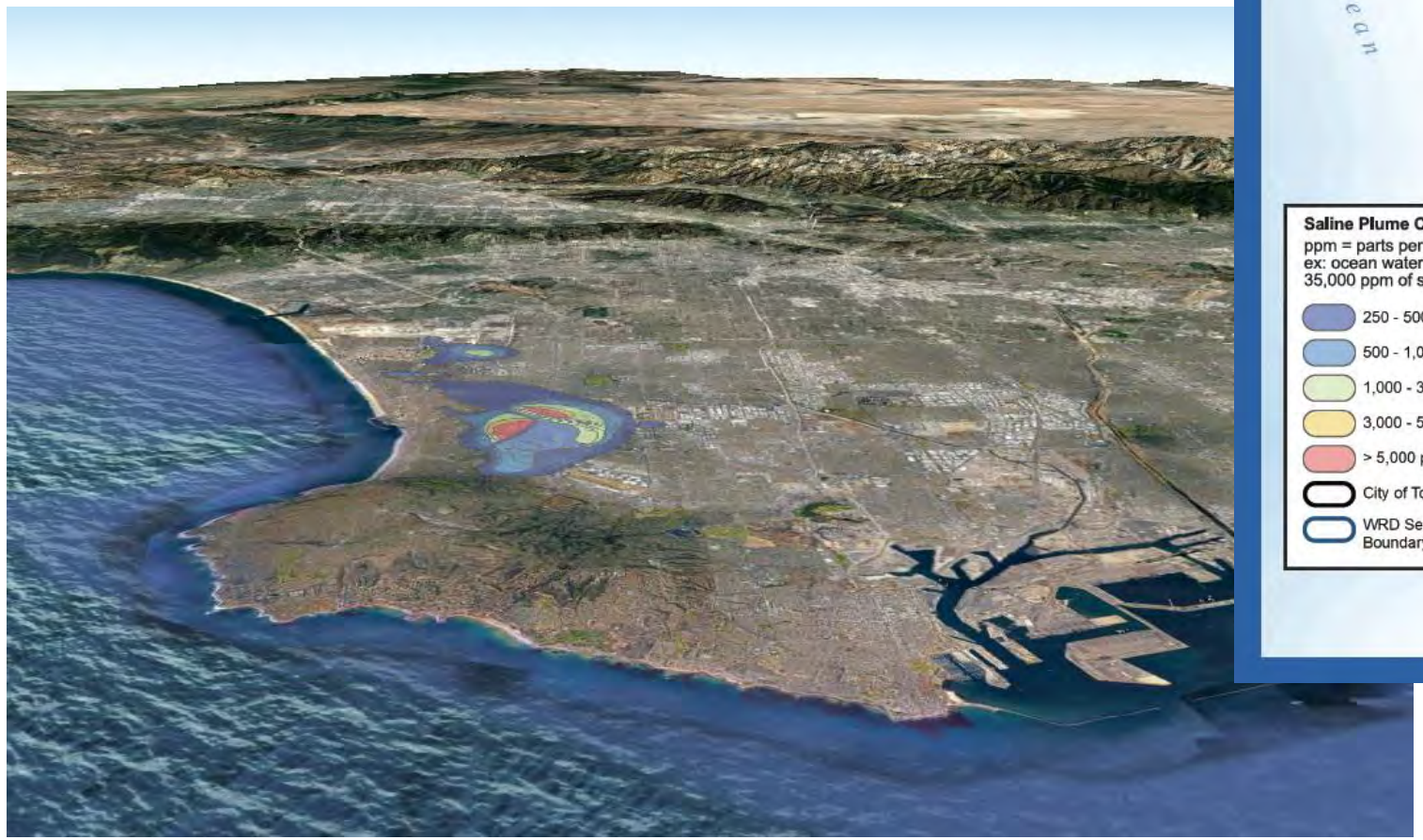
=

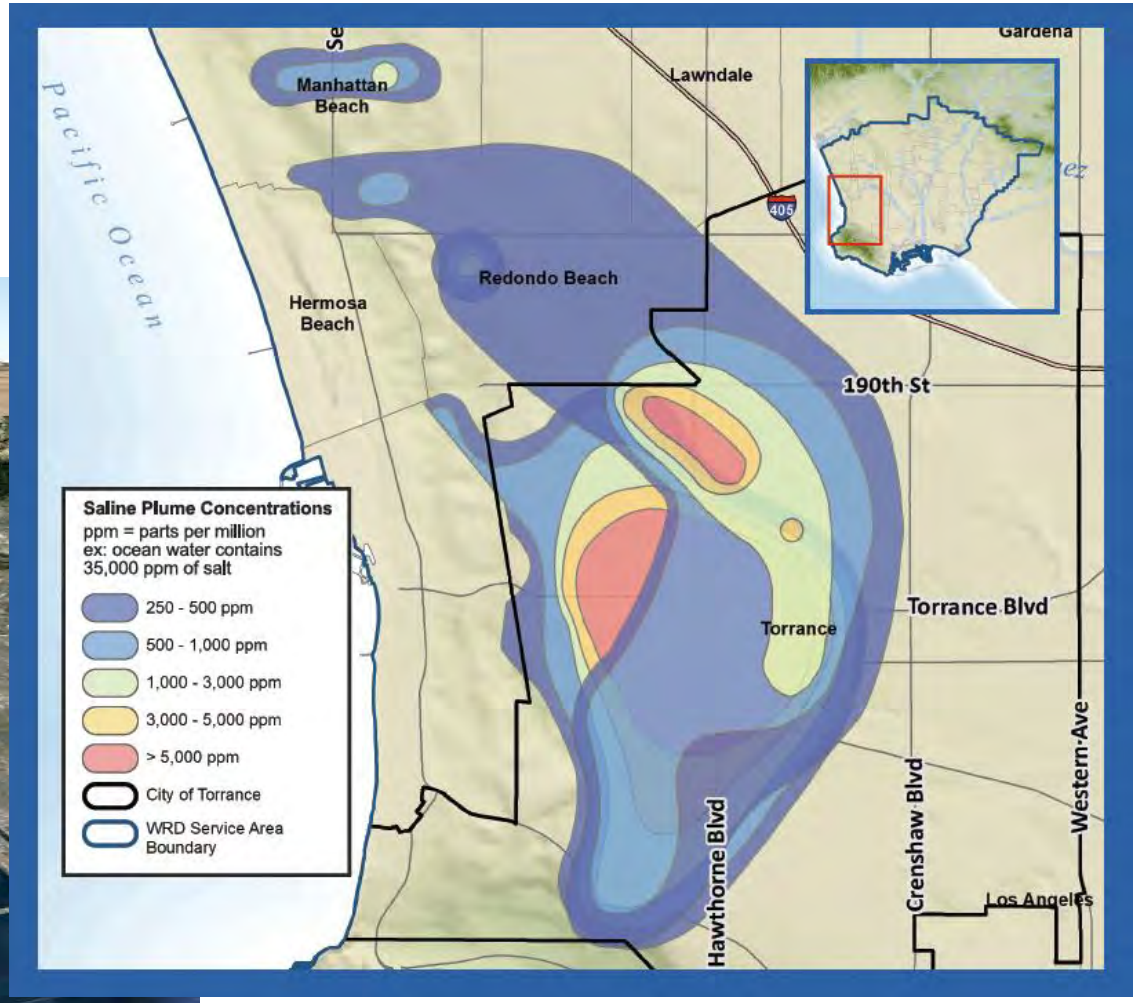
Locally Sustainable Water Supply for Region

WIN 4 ALL
THE 2040 PLAN FOR REGIONAL WATER INDEPENDENCE

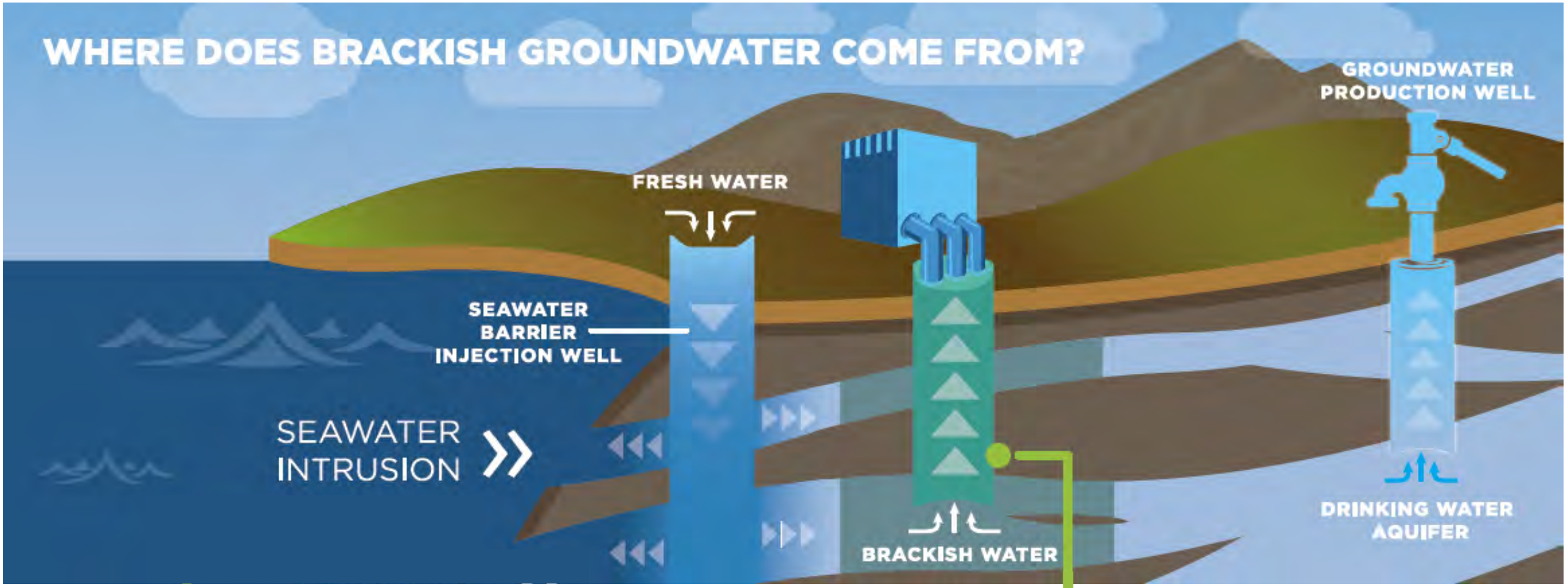
WIN 4 ALL also includes a new groundwater desalter project

WIN 4 ALL
THE 2040 PLAN FOR REGIONAL WATER INDEPENDENCE





Brackish water was trapped inland after injection wells were installed



10 million gallons per day of brackish water can be extracted and treated using reverse osmosis

Treatment is already underway at WRD's Goldsworthy Desalter in Torrance

WRD
WATER REPLENISHMENT DISTRICT

Thank You!

Everett Ferguson, Senior Hydrogeologist
eferguson@wrd.org

BOARD OF DIRECTORS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Division 1


Robert Katherman
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Division 5

Stephan Tucker
General Manager

SECURING OUR WATER FUTURE TODAY

WRF Project No. 5196

ONE WATER PROGRAM MANAGEMENT – A Knowledge Base and Guidance Manual

LA/OC WateReuse Summit

October 8, 2024

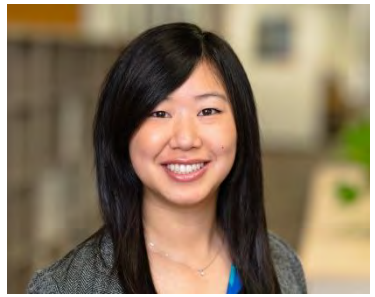
HDR Research Team

Julie L. Labonte, PE
Principal Investigator

Jacquelin Mutter, MBA
Co-Principal Investigator

Scott Aurit, PE
Co-Principal Investigator

Karen Pappas, PE
Co-Principal Investigator



Alice Wang, PE
Project Manager

Project Partners

City of Los Angeles Department of Water & Power (LADWP)

City of Los Angeles Sanitation & Environment (LASAN)

THE Water Research FOUNDATION

Utility Participants

Aguas de Portugal Internacional/AdP Valor Grupo Aguas de Portugal

City of San Diego Public Utilities Department

City of San Francisco Public Utilities Commission

Hampton Roads Sanitation District

High Speed 2

Indian River County

Johnson County Wastewater

Los Angeles World Airports

Metropolitan Water District of Southern CA

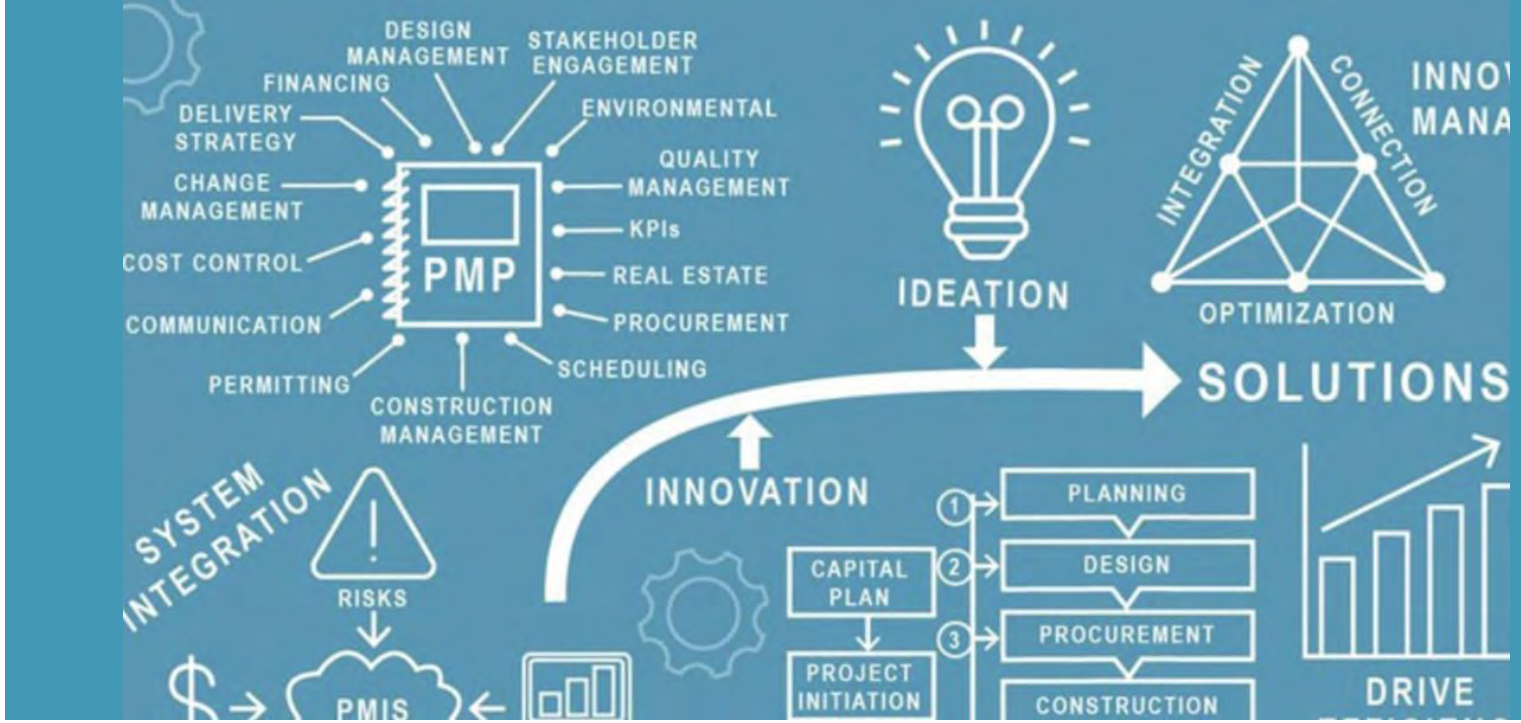
Miami-Dade Water & Sewer Department

Passaic Valley Sewerage Commission

Philadelphia Water Department

Region of Peel Water & Wastewater

AGENDA



01 Defining One Water Program Management

02 Program Management Framework

03 Pure Water Southern California Case Study

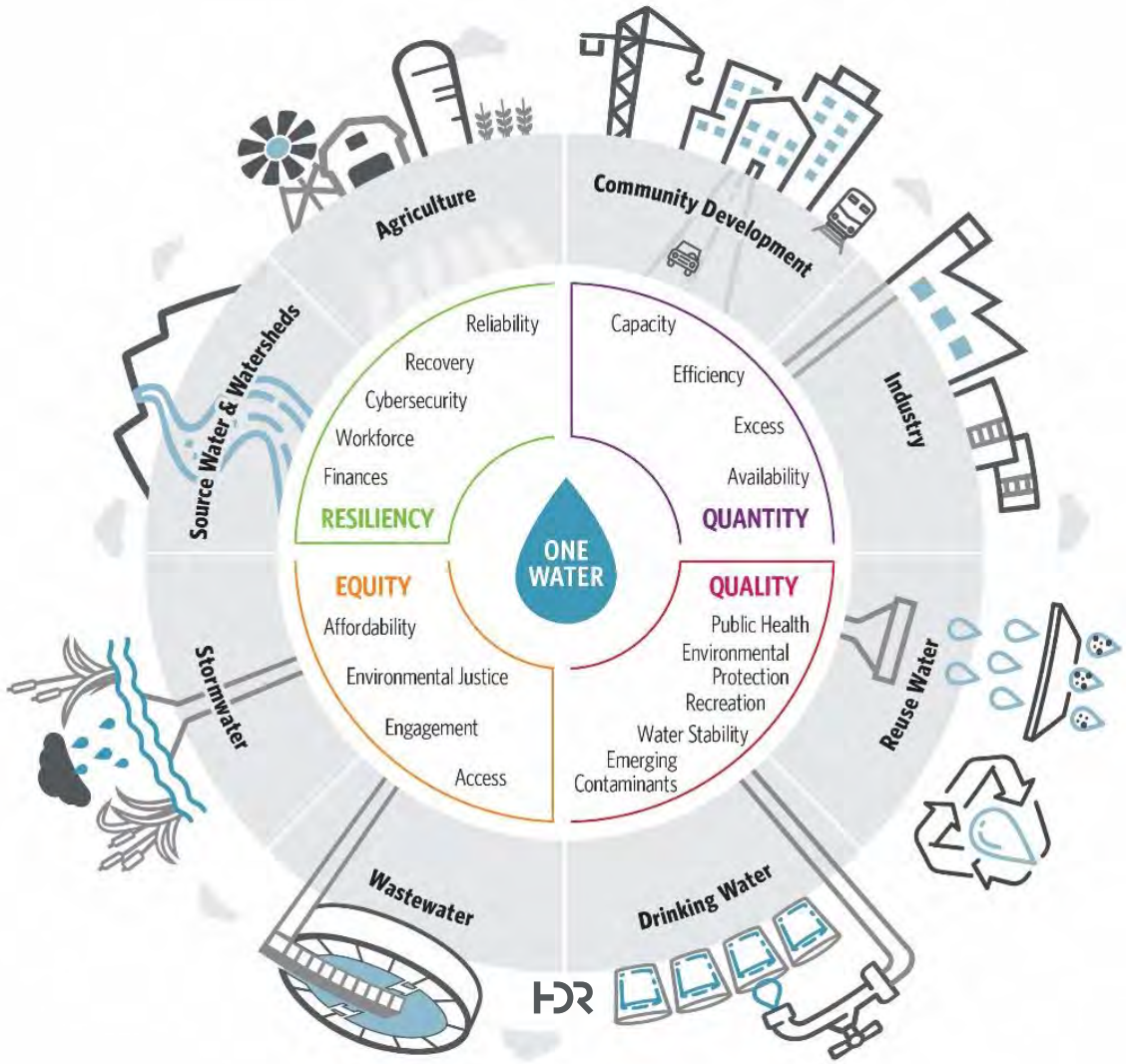
01

Defining One Water Program Management

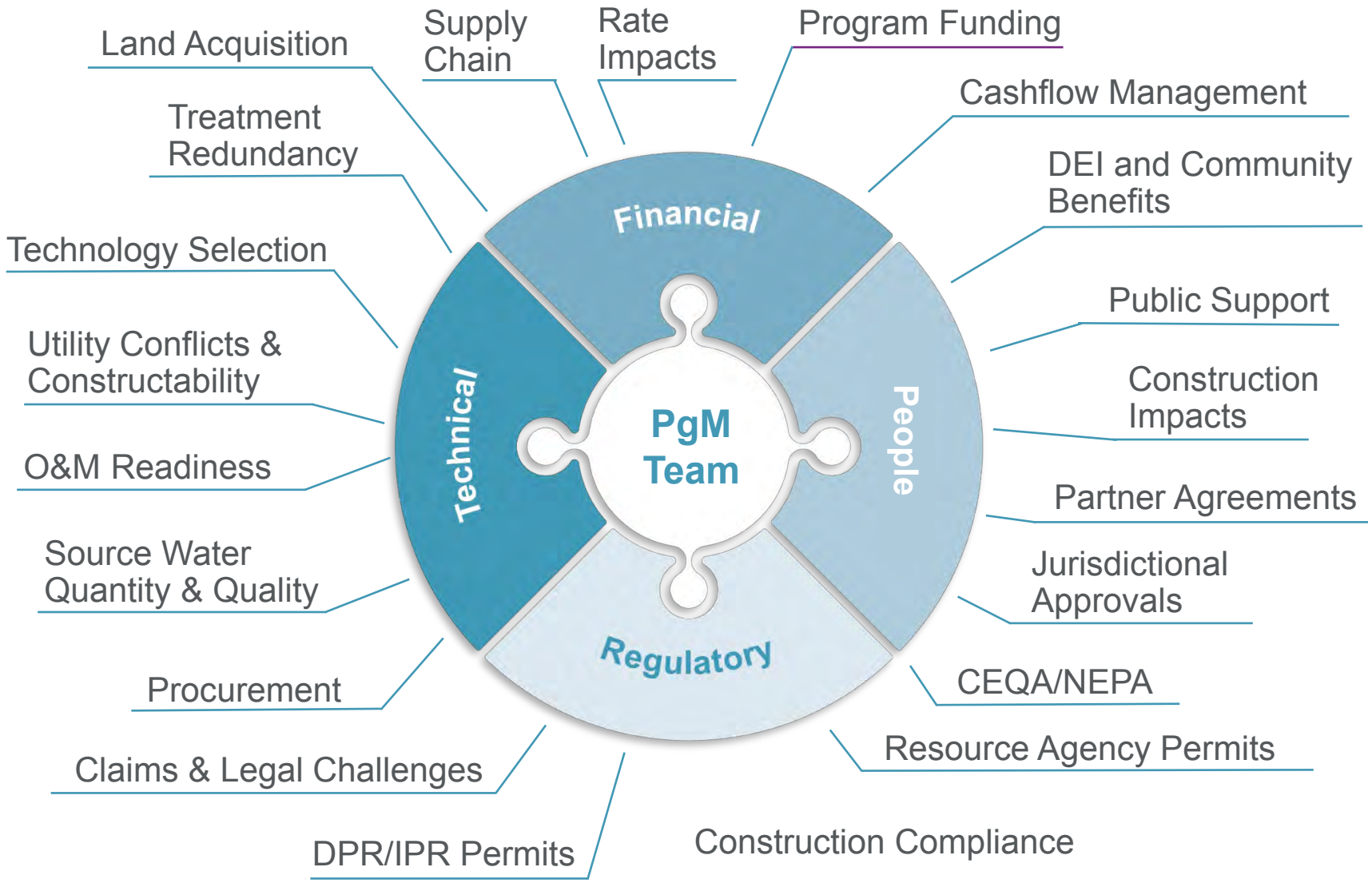
Applying a One Water Lens to Water Reuse Programs

Addressing today's water challenges by exploring the interconnectivity between elements of the urban hydrologic cycle.

Collaborating across institutional boundaries to create 'best value' projects that are implementable, affordable, and equitable.

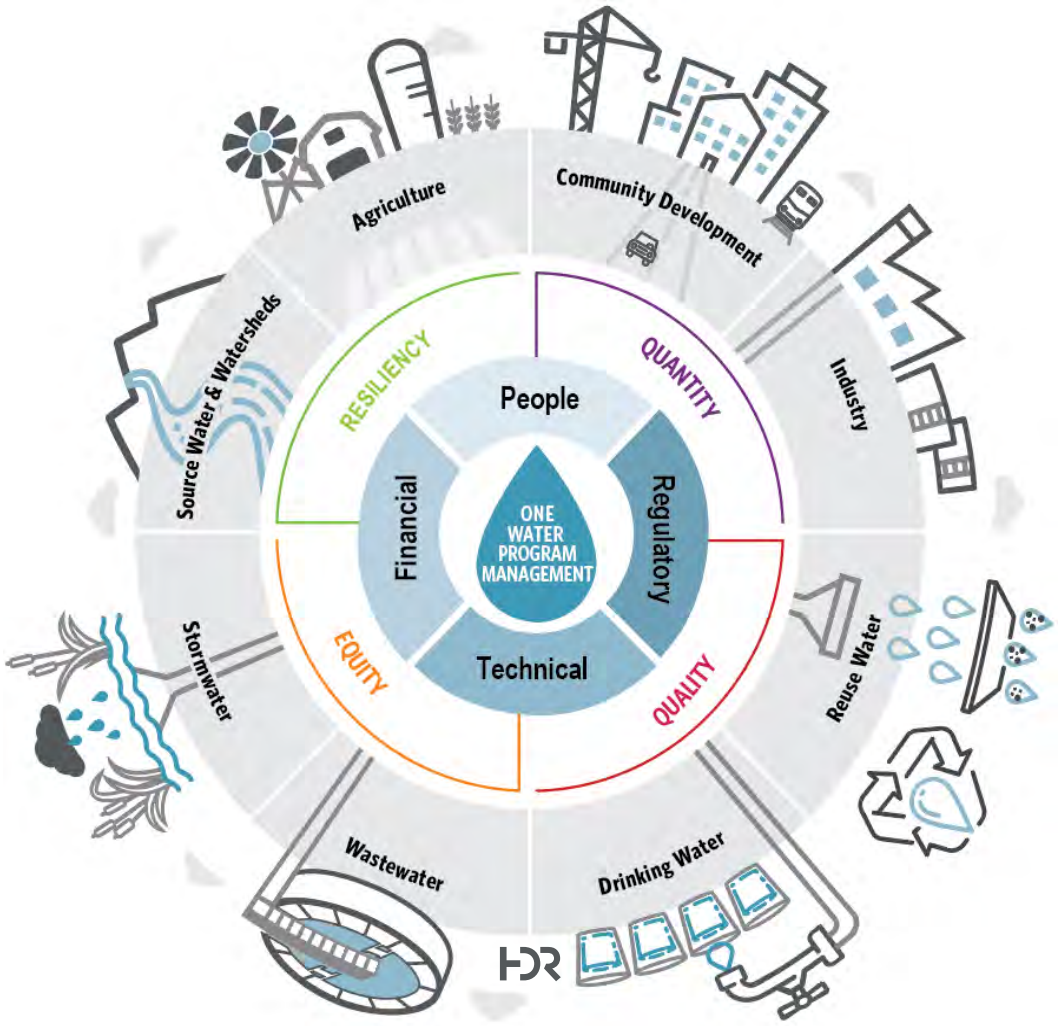


Managing & Integrating the Five (5) Facets of an Infrastructure Program



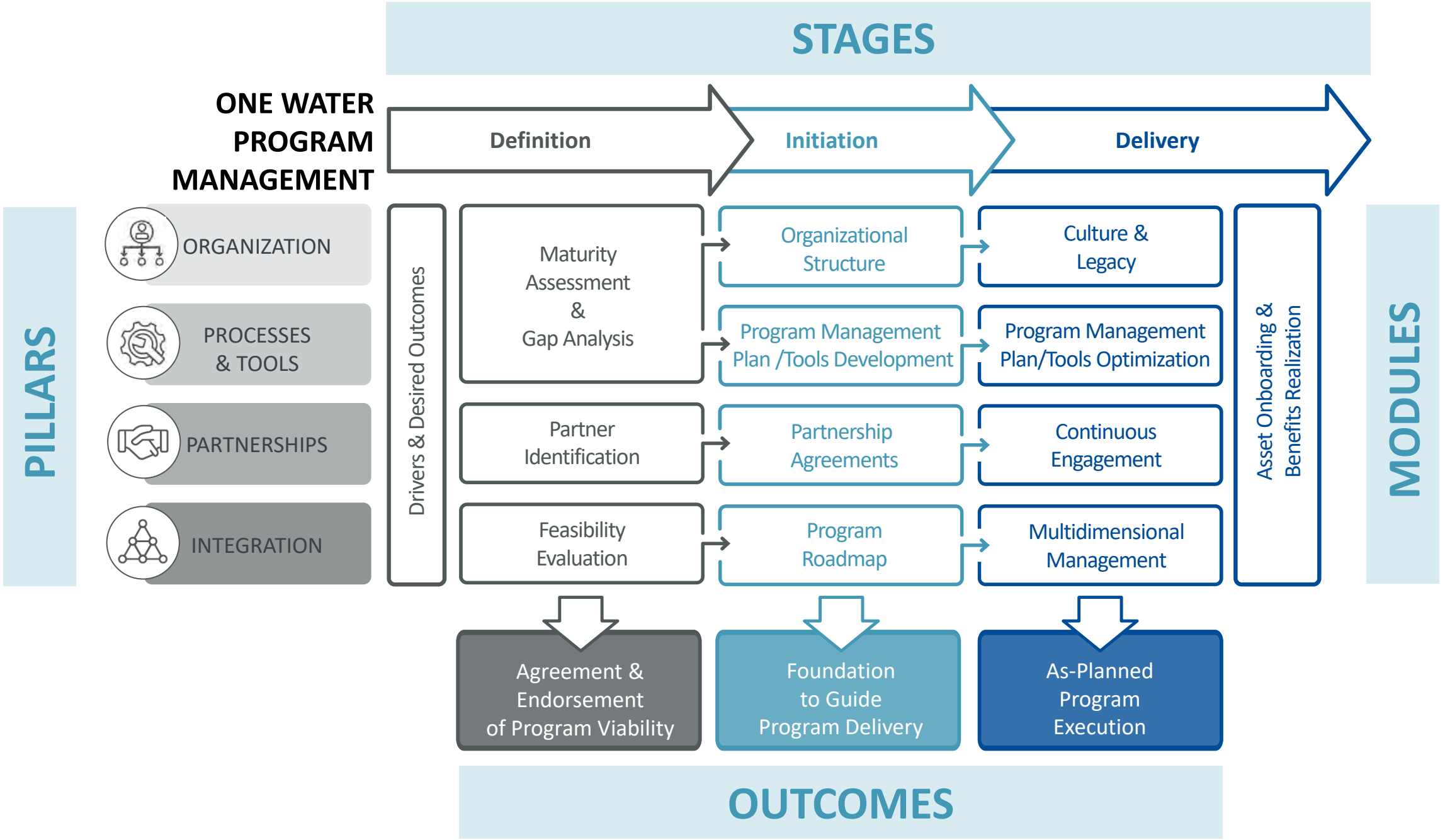
One Water Program Management…

Efficiently plan and deliver **interrelated** water projects in an **integrated** and coordinated manner to realize an overarching **desired outcome** with greater **execution certainty** and commit to achieving broader business, community, and environmental **benefits**.



02

Framework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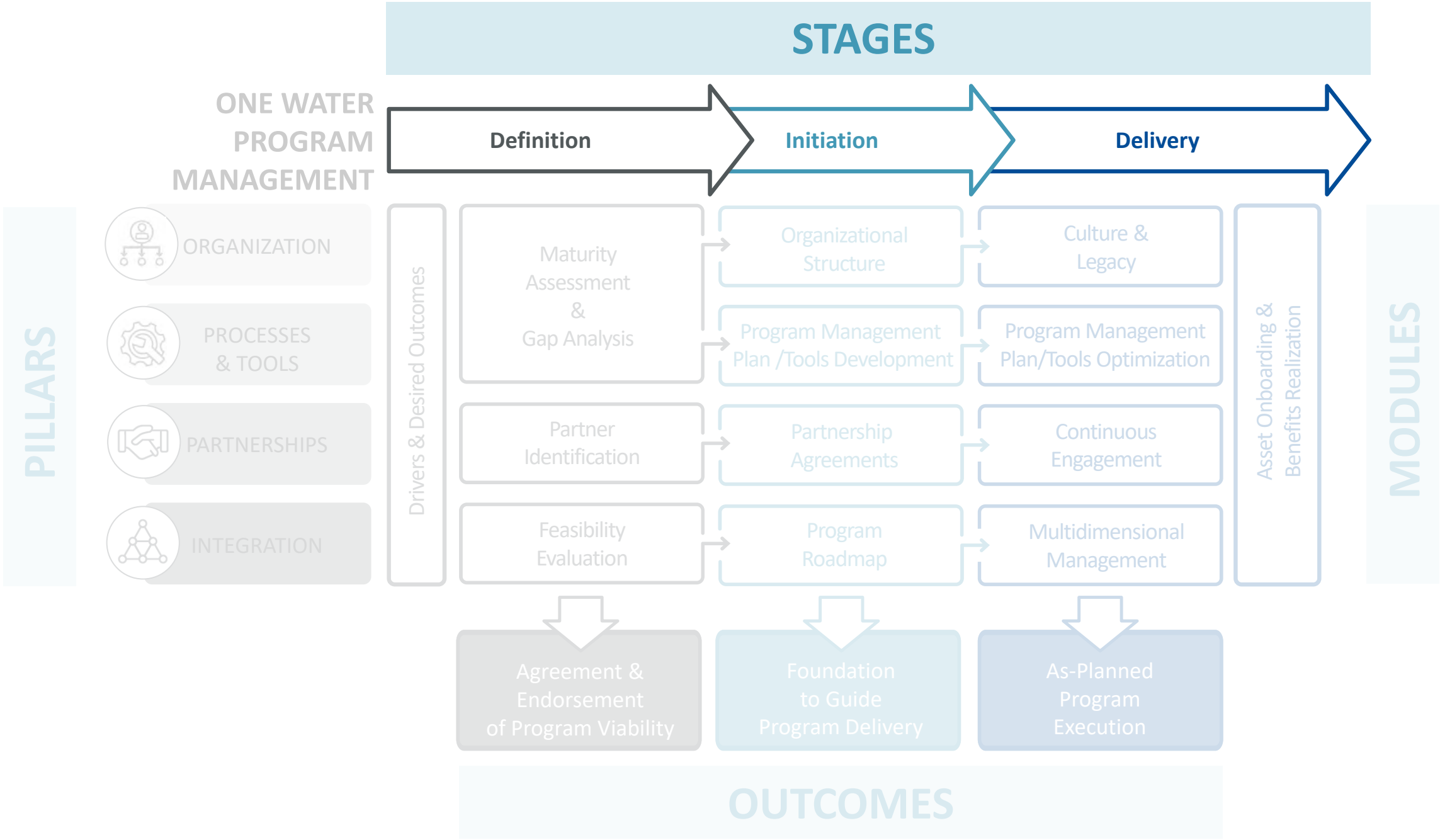
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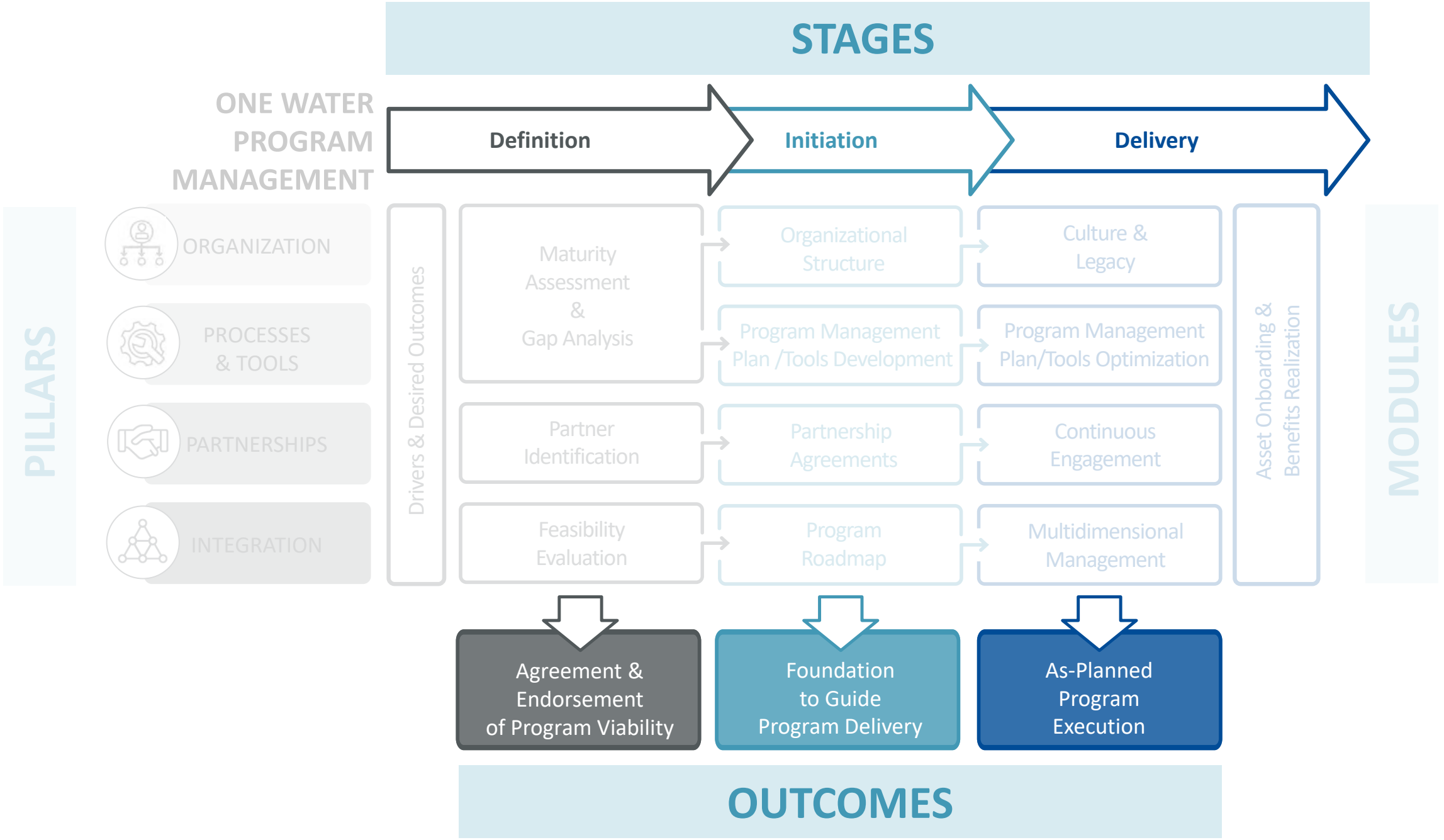
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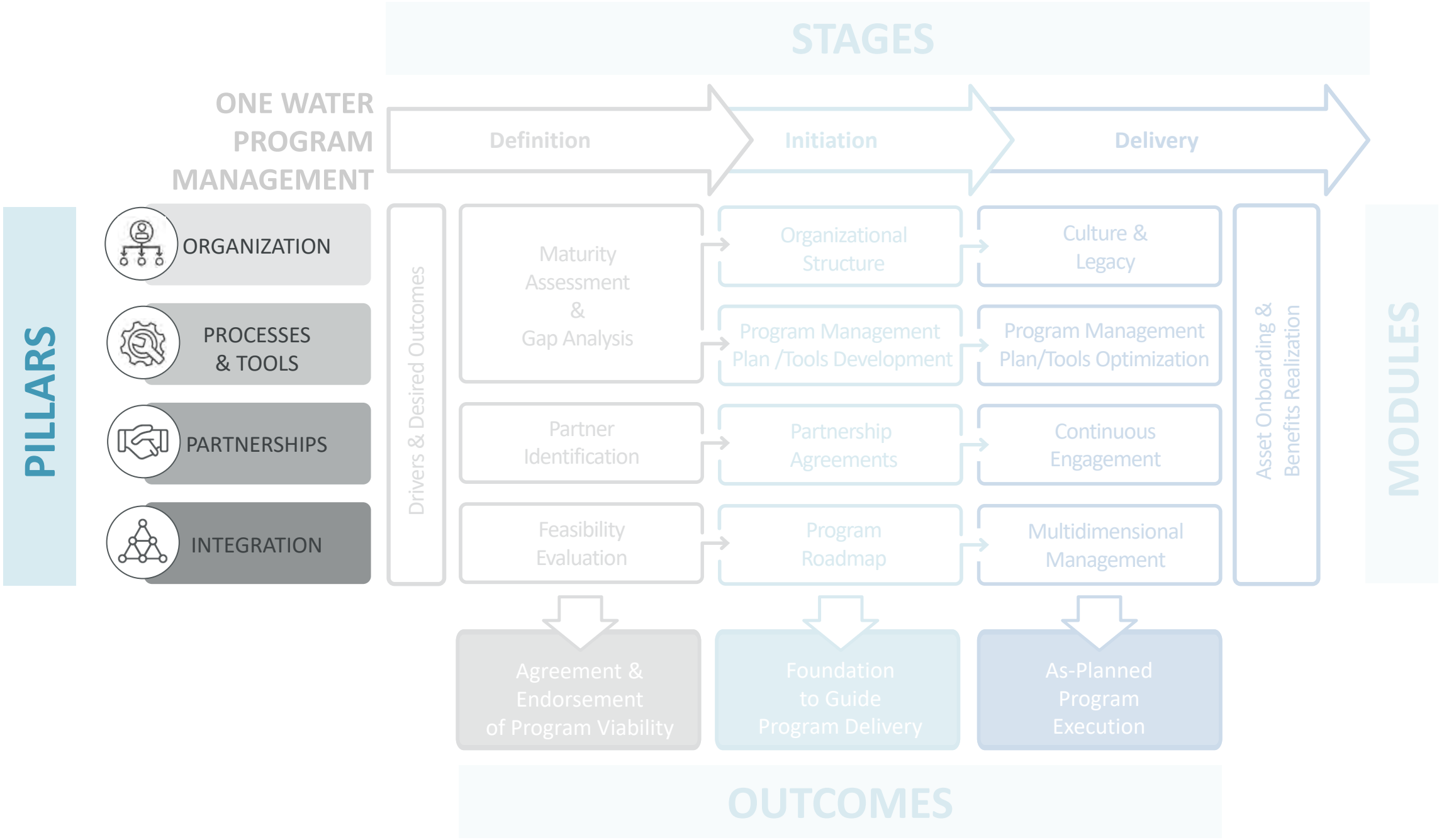
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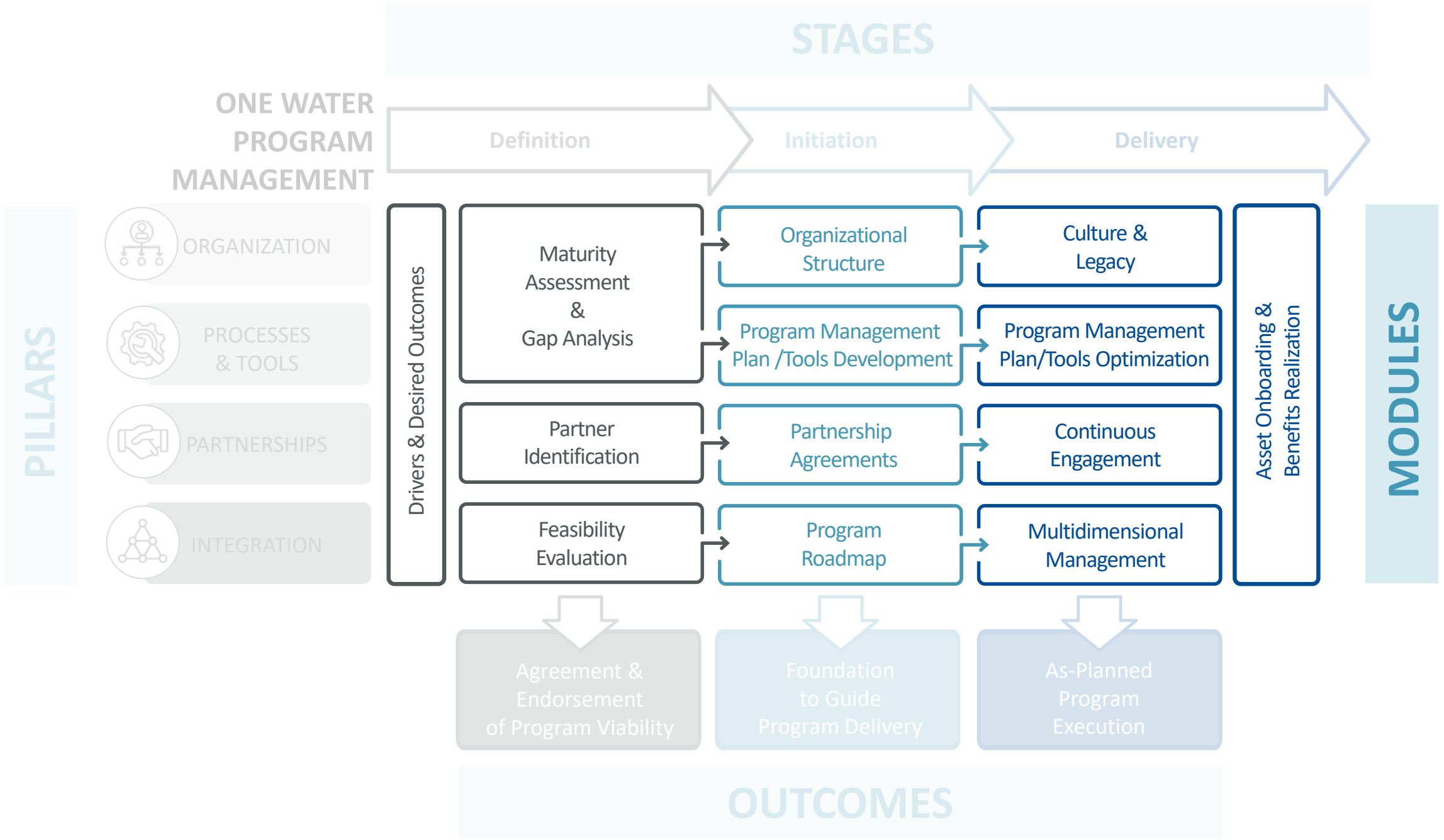
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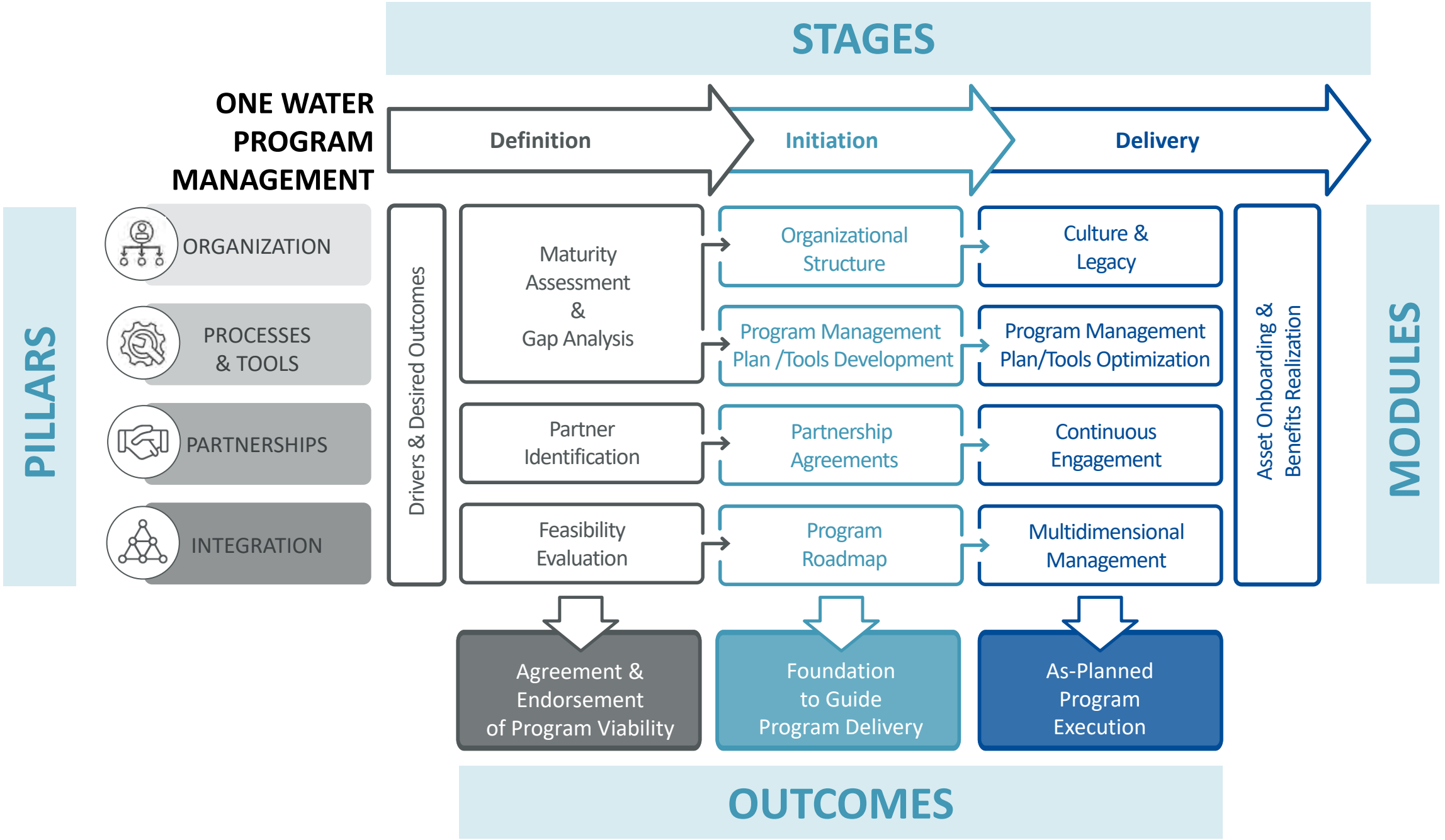
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03

Pure Water Southern California Case Study

Partnerships Agreement Case Study
Pure Water Southern California

Essential partnership between Metropolitan and LACSD established a MOU in 2010 to produce 150 mgd of purified recycled water by 2032, future proofing our regional drinking water supplies.

Partnership Strategies and Best Practices

1. Establish Partner Champions
2. Define the Partnership and Program
3. Establish Regular Communication
4. Formalize Partnership Agreements

Lessons Learned

- ✓ Leadership comes from the top.
- ✓ The initial vison may not be where you end up.
- ✓ Ensure appropriate staff and resources to make the partnership successful.

Metropolitan and LACSD at Demonstration Plant. General managers at demonstration plant groundbreaking event in 2017. *Source: Metropolitan.*

Metropolitan and LACSD Technical Staff. Located at the future project site during a partnership meeting. *Source:* Metropolitan.

Woodard & Curran

Singing Your Praises: The Ripple Effect of Storytelling

Katie Evans, Senior Communications Strategist

WateReuse Chapter Meeting

Ripple Effect: Recycle, Recharge, Repeat

October 8, 2024

Quick Exercise

Think of a news story you've recently heard about.

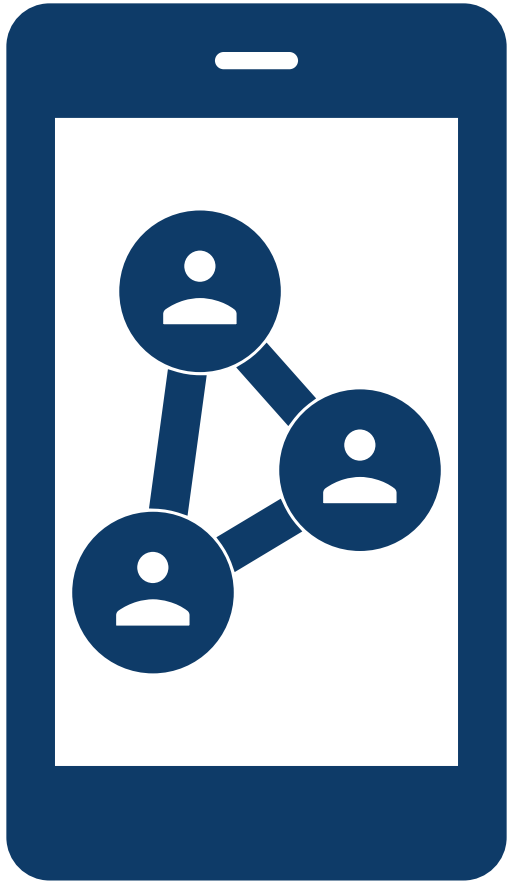
Quick Exercise

Did anyone think of something local?

Quick Exercise

Did anyone think of something positive?

What we are up against



- We see between 4,000 and 10,000 ads a day
- The average human attention span has decreased, some even say to 8 seconds
- Cost of getting a consumer's attention has increased seven- to nine- fold over the past two decades

Why should we care?

- When people understand what we are doing they are more likely to support us
  - Board votes
  - Funding agency support
  - Elected officials' endorsement
  - Ratepayer approval

The Solution:

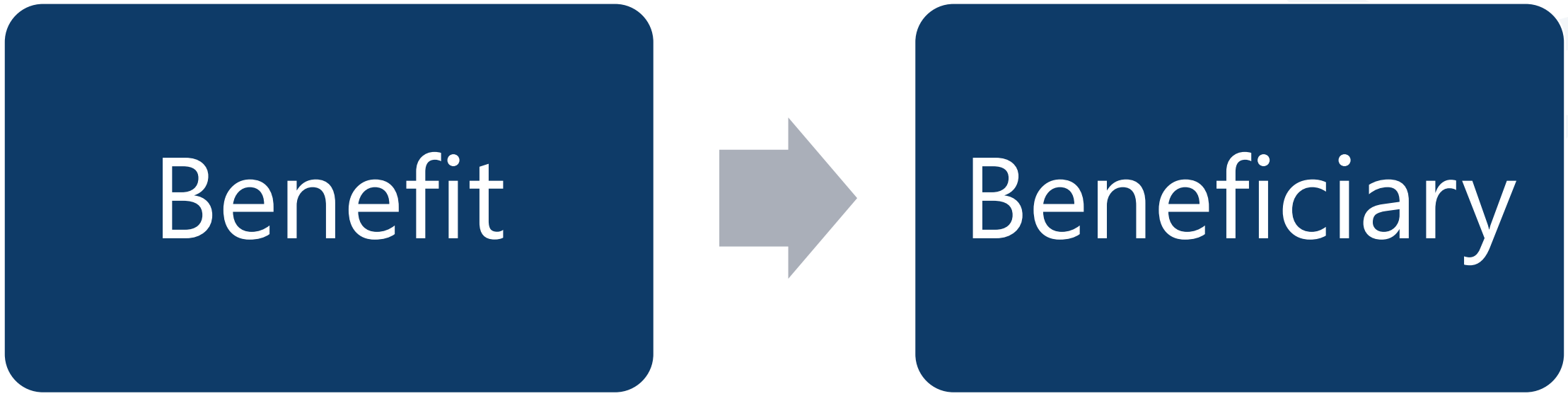
Storytelling

Woodard & Curran

Storytelling

- Not simply the what…
- Why?
  - Impact
  - Relevance
  - Meaning

Storytelling Multibenefit Projects



In a way that makes sense to them!

Examples:

Storytelling Done Well

Woodard & Curran

Harvest Water

Harvest Water

Facilitates Groundwater Recovery

- Allows for use of recycled water instead of pumped groundwater for irrigation
- Raises local groundwater levels by up to 35 feet over 15 years, increasing groundwater in storage by approximately 370,000 acre-feet which is about one-third the capacity of Folsom Lake
- Increases regional and state water supply reliability

Harvest Water

Strengthens Local Habitats

- Improves groundwater conditions to sustain over 5,000 acres of riparian and wetland habitats
- Enhances habitats for a variety of listed species, including Sandhill crane, Swainson's hawk, and Giant garter snake
- Increases streamflow in the Cosumnes River, supporting a longer migration window for Fall-run Chinook Salmon
- Reduces salinity and nutrients in the Sacramento and Delta waterways

Harvest Water

Boosts Sustainable Agriculture

- Delivers up to 50,000 acre-feet per year of reliable recycled water—approximately 16 billion gallons of water—to directly irrigate more than 16,000 acres of agricultural lands
- Restores and manages groundwater in partnership with area landowners, farmers, and ranchers
- Stabilizes water supply for the region's farms, ranches, and rural landscapes by providing a reliable, cost-effective long-term water supply

Carpinteria Advanced Purification Project

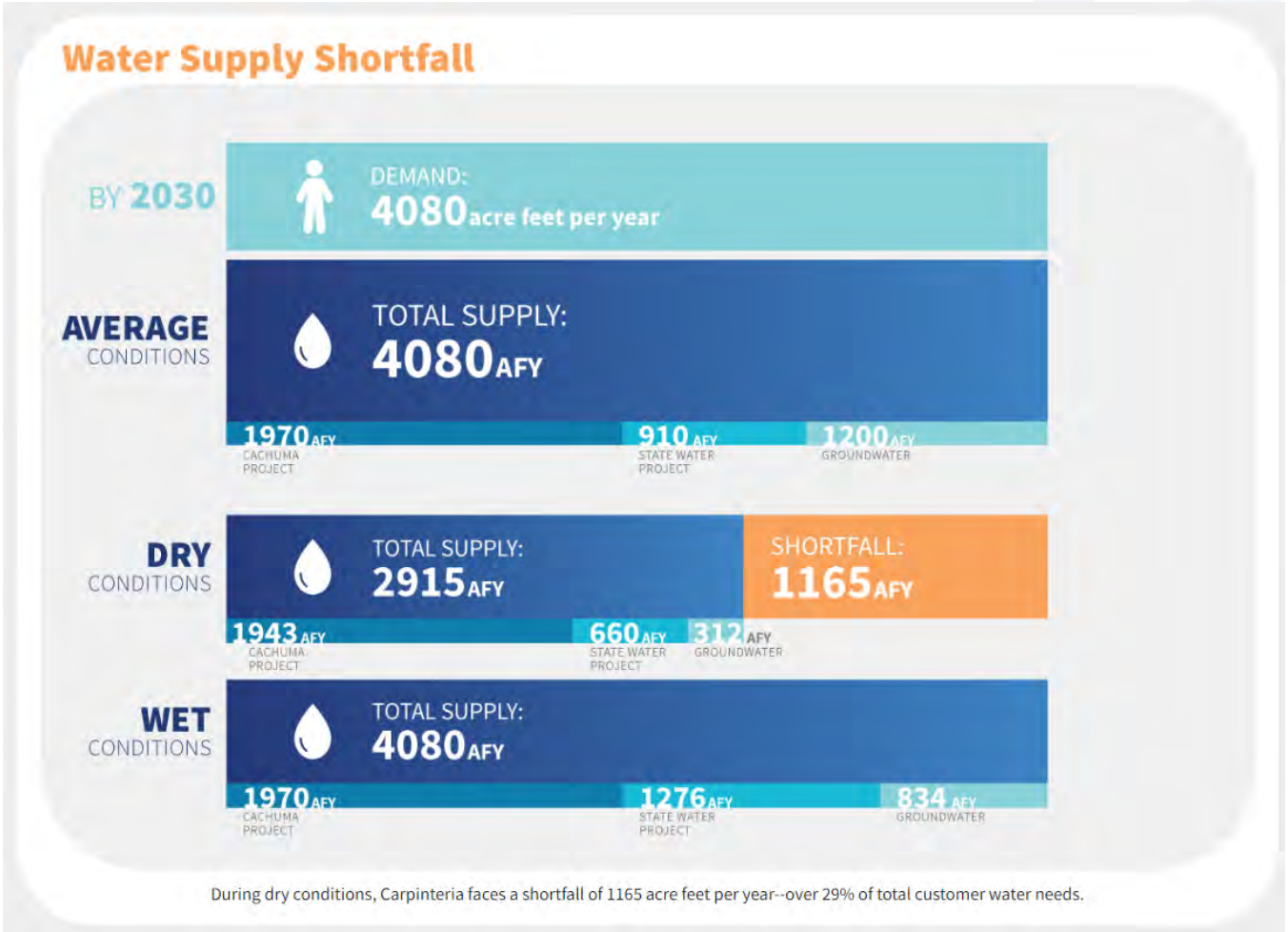
CAPP | **Carpinteria Advanced Purification Project**
Replenishing Our Groundwater for the Future

The Carpinteria Advanced Purification Project (CAPP) will replenish the groundwater basin with purified recycled water, creating a locally-controlled, drought-resistant drinking water supply.

CARPINTERIA VALLEY WATER DISTRICT
CARPINTERIA

A collaborative effort to replenish our groundwater

Carpinteria Advanced Purification Project



During dry conditions, Carpinteria faces a shortfall of 1165 acre feet per year--over 29% of total customer water needs.

Carpinteria Advanced Purification Project

3. How does this project benefit those of us who live in Carpinteria?

The primary benefit of CAPP is that it provides a new, local supply of water that is independent of climate impacts and competing water needs. It also provides a high-quality source of water to replenish our groundwater basin and reduces the amount of valuable water we discharge to the ocean each day. CAPP is one of many efforts – including continued focus on conservation – to offset declining water resources and improve water supply reliability.

Tagline Face-off!

Woodard & Curran

Hypothetical Project

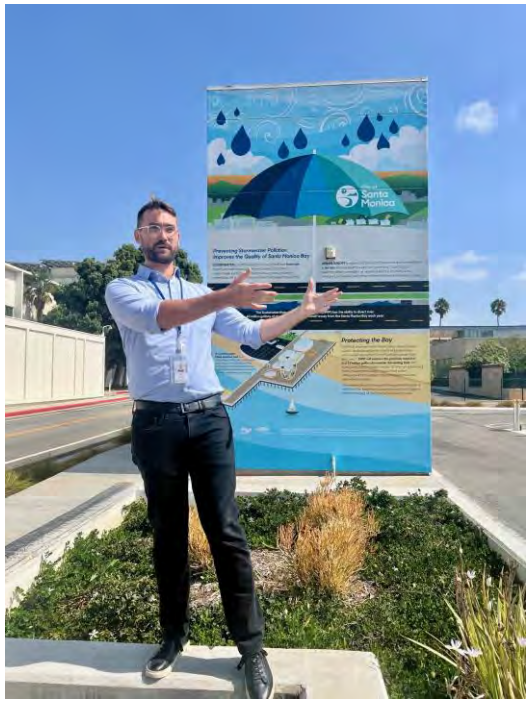
- Current water treatment of 31 mgd
- Reuse capacity for 20 mgd
- Eliminates like amount of ocean discharge
- Cost in today's dollars is upwards of $200 million
  - Results in a cost of water lower than any imported supply over the next 40 years

Menti Poll

Visit Menti.com
Code: 9281 8356

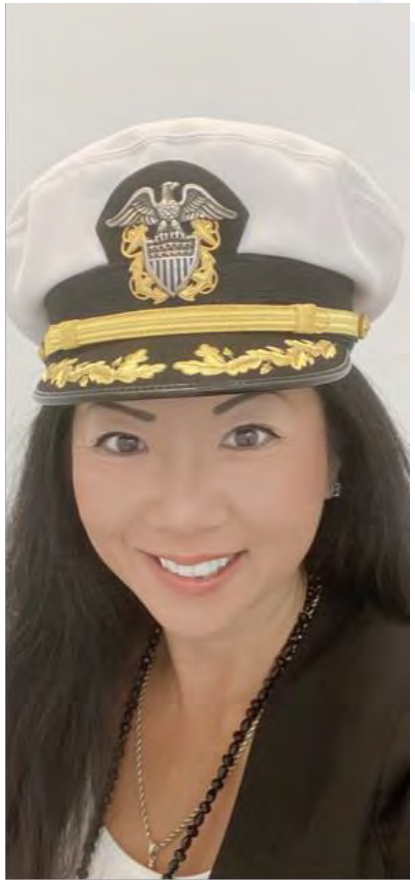
Faceoff Opponents

Alex “the Waite is over” Waite!



vs.

Joone “Captain Communications” Lopez!



Audience: Board of Directors

- Pure Water, Pure Future
- Recycle today to reclaim tomorrow

Audience: Active Environmental Community

- Pure Water, Healthy Oceans: A Dual Commitment
- Nourishing Communities, Protecting Oceans

Audience: Ratepayers

- Securing Water, Securing Futures
- Sustainable Water Solutions for Generations

Q&A

Woodard & Curran

Woodard & Curran

Thank you!

Katie Evans

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Hazen

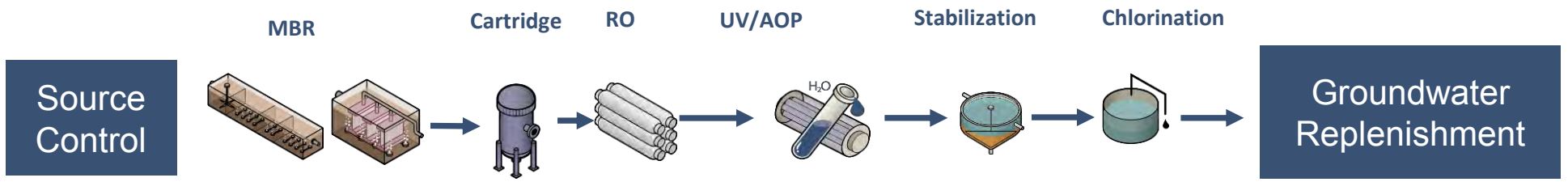
Optimizing Water Reuse: Effective Management of IPR and DPR Operations

Nathan Boyle, PE

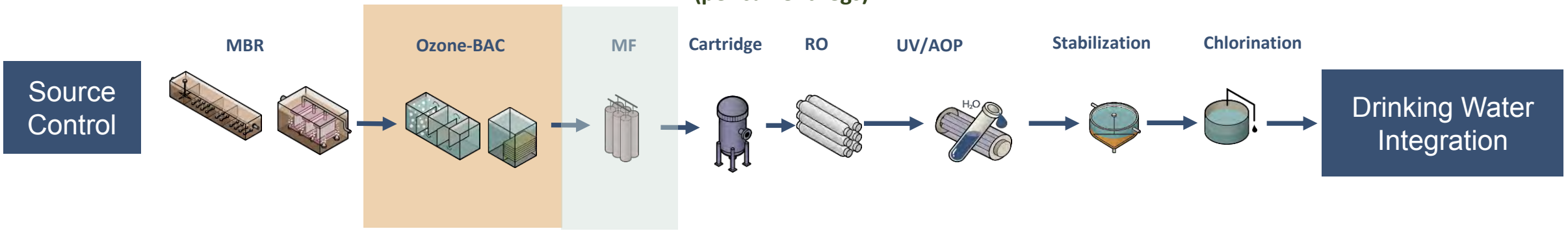
LA and OC WateReuse Summit 2024

IPR and DPR Trains – Managing Operations across traditional boundaries

Indirect Potable Reuse



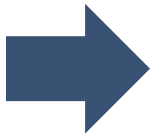
Direct Potable Reuse (per current regs)



Risk Management forms the basis of Operational Management

Risk Management

Critical Control Points



Asset Management

Risk and Compliance

Management and Staffing

Asset Management

Laboratory

Staffing

Maintenance

Data Management

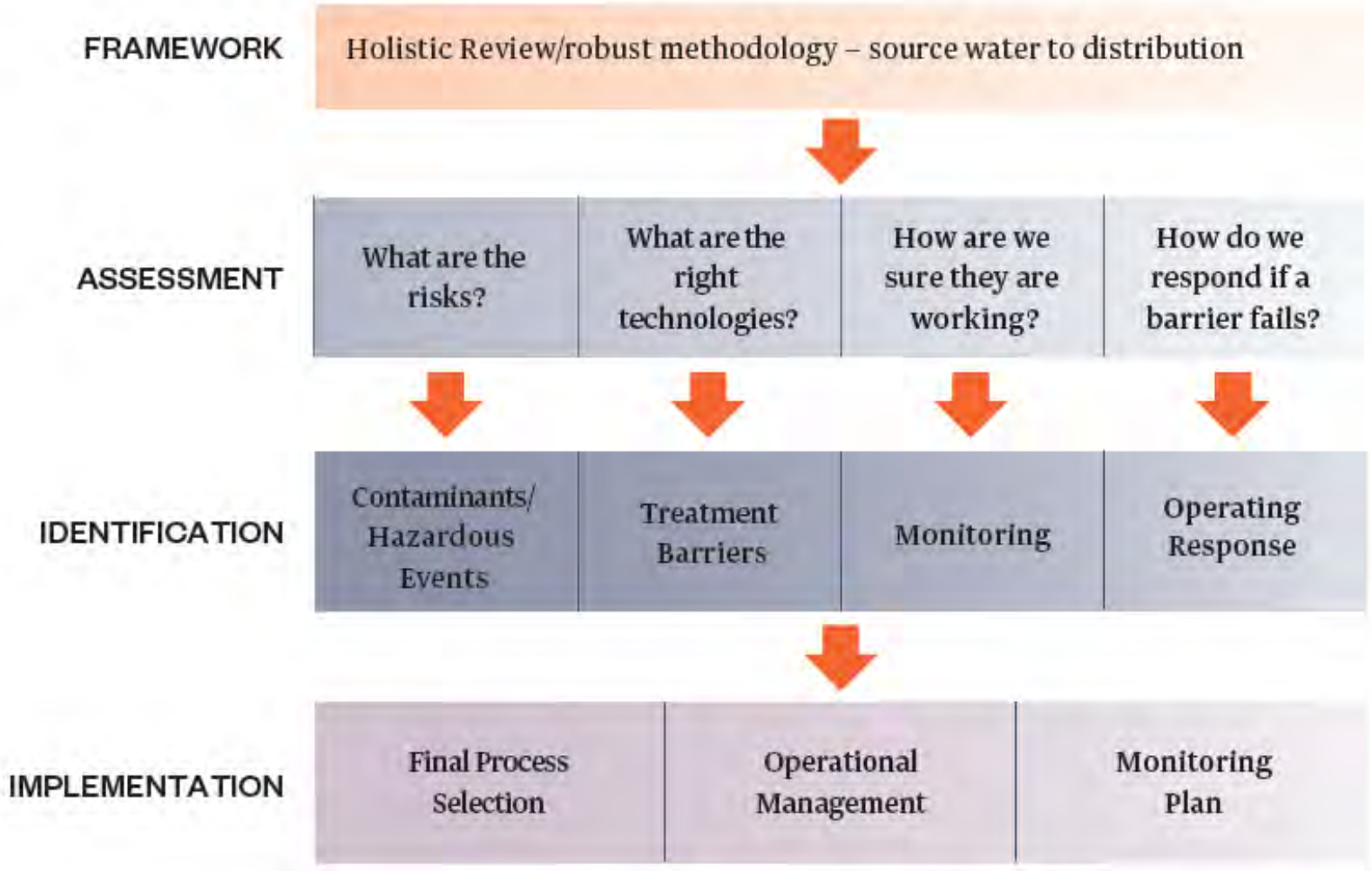
Operator Training and Certification

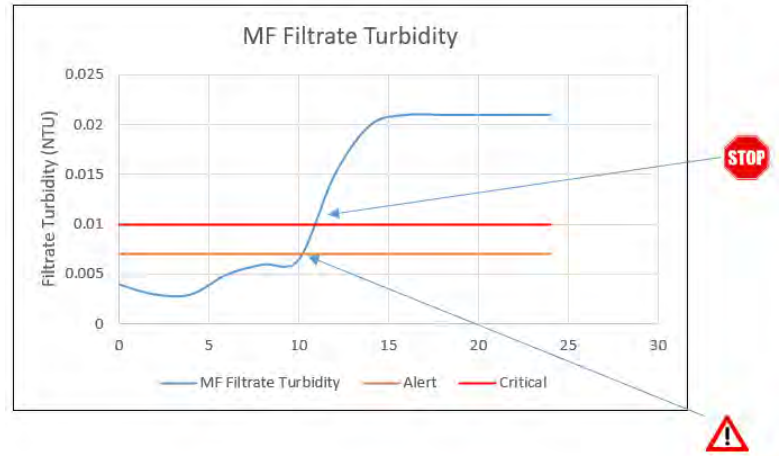
Emergency Response Procedures

COST $$

HACCP to Control Risk

Critical Control Points





Source: Reuse 15-05

Critical Control Points

Critical Control Points

Critical Monitors tell us that the CCPs are working effectively

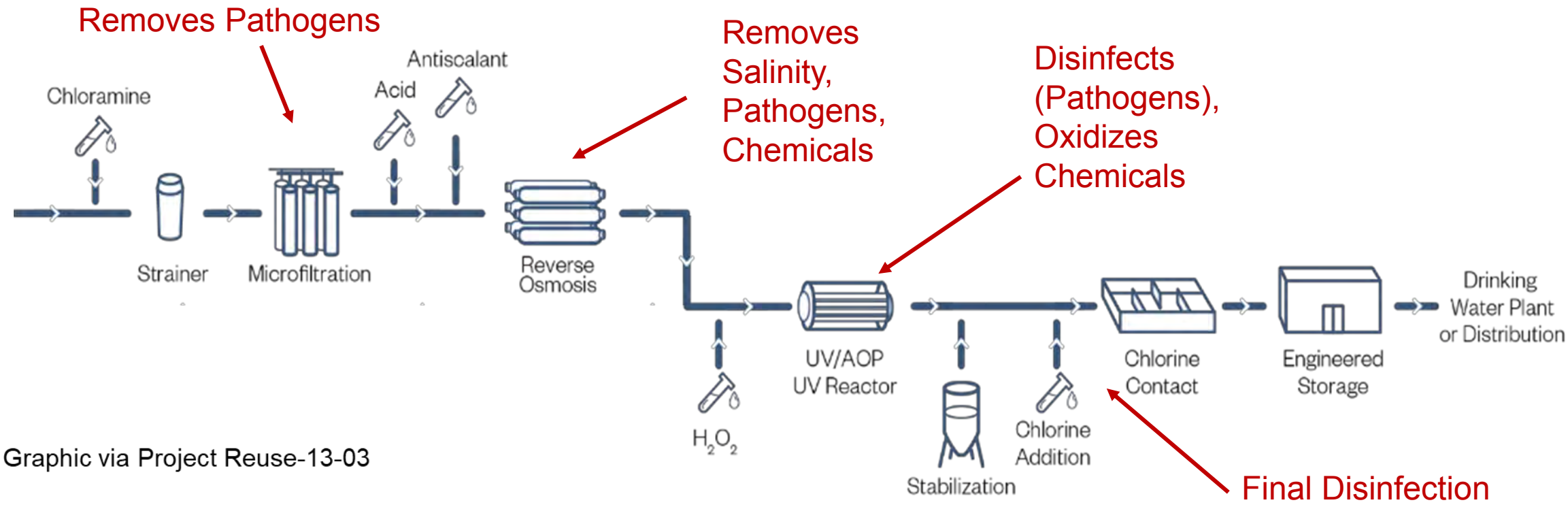
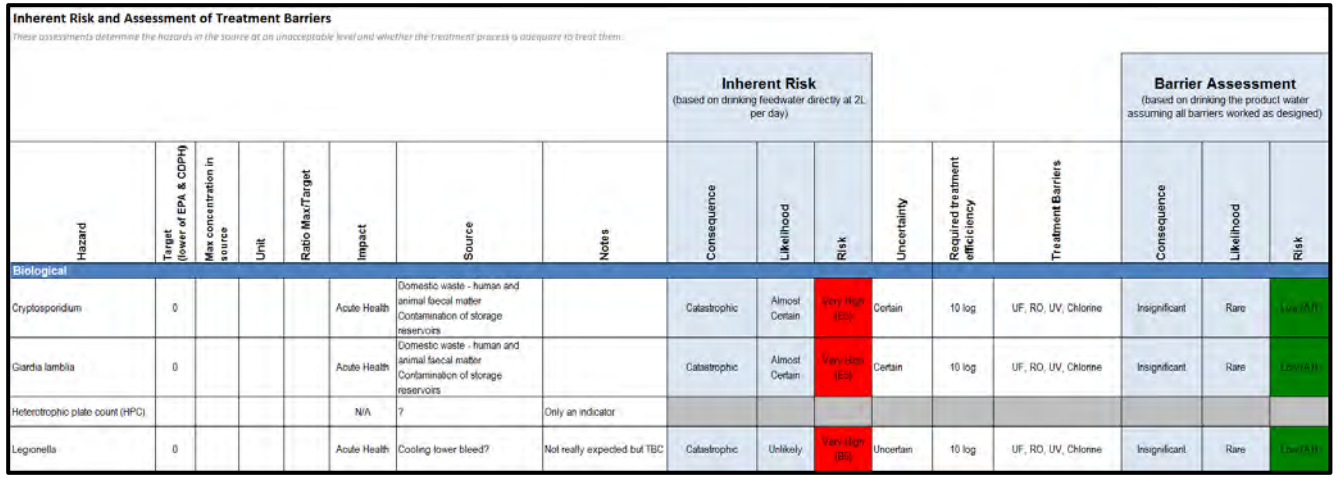


Table and Graphic via Project Reuse-13-03

Example Risks in a Reuse Facility

Example Risks in a Reuse Facility:

- Industrial Discharger sending high chemical load to sewer
- Pathogens
- WRF process upset/bypass
- Membrane integrity failure
- Emerging Contaminants/Pharmaceutical Products
- Power outage
- Instrument failure
- Malicious threats/cyber
- ….



Inherent Risk and Assessment of Treatment Barriers

These assessments determine the hazards in the source at an unacceptable level and whether the treatment process is adequate to treat them.

								Inherent Risk (based on drinking feedwater directly at 2L per day)						Barrier Assessment (based on drinking the product water assuming all barriers worked as designed)		
Hazard	Target (lower of EPA & CDPH)	Max concentration in source	Unit	Ratio Max/Target	Impact	Source	Notes	Consequence	Likelihood	Risk	Uncertainty	Required treatment efficiency	Treatment Barriers	Consequence	Likelihood	Risk
Biological																
Cryptosporidium	0				Acute Health	Domestic waste - human and animal faecal matter Contamination of storage reservoirs		Catastrophic	Almost Certain	Very High (E5)	Certain	10 log	UF, RO, UV, Chlorine	Insignificant	Rare	Low (A1)
Giardia lamblia	0				Acute Health	Domestic waste - human and animal faecal matter Contamination of storage reservoirs		Catastrophic	Almost Certain	Very High (E5)	Certain	10 log	UF, RO, UV, Chlorine	Insignificant	Rare	Low (A1)
Heterotrophic plate count (HPC)					N/A	?	Only an indicator									
Legionella	0				Acute Health	Cooling tower bleed?	Not really expected but TBC	Catastrophic	Unlikely	Very High (B5)	Uncertain	10 log	UF, RO, UV, Chlorine	Insignificant	Rare	Low (A1)

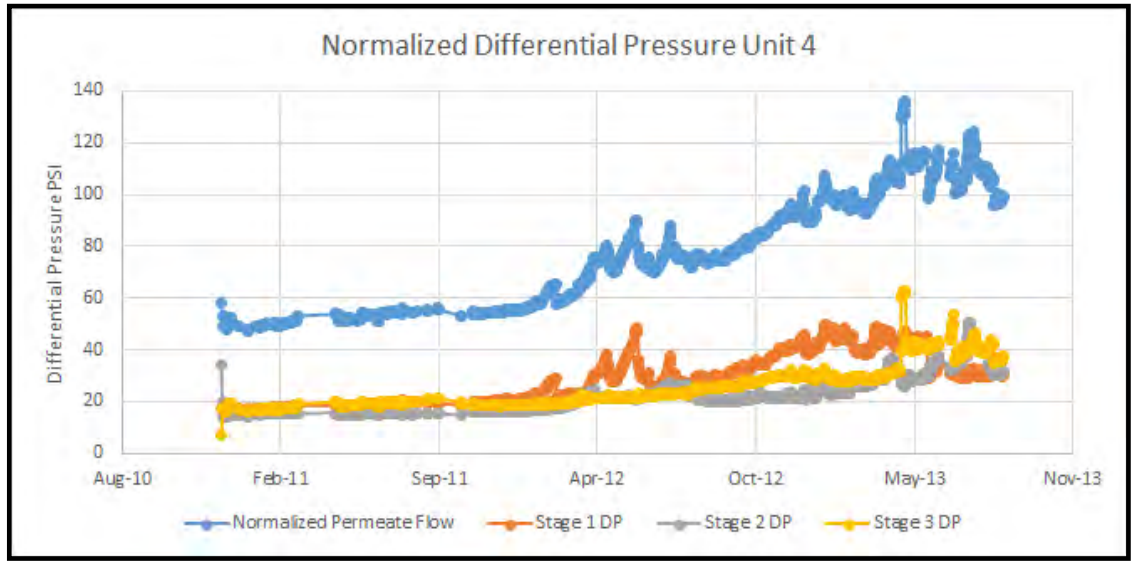
Asset Management

Asset Management

- High count of critical assets
- Priority on analyzers, control systems and automation
- Conditions can be hard on equipment - Chemical addition, corrosive water
- What spares to keep on hand?
- Maintaining quality CMMS data
- Setting a high bar : The PM / Total Maintenance Ratio

Maintenance

Maintenance



- Prioritizing key equipment
- **Preventative and proactive** rather than corrective and reactive
- Cost benefits of balancing maintenance intervals
- The ‘little’ things can cause big headaches

Laboratory

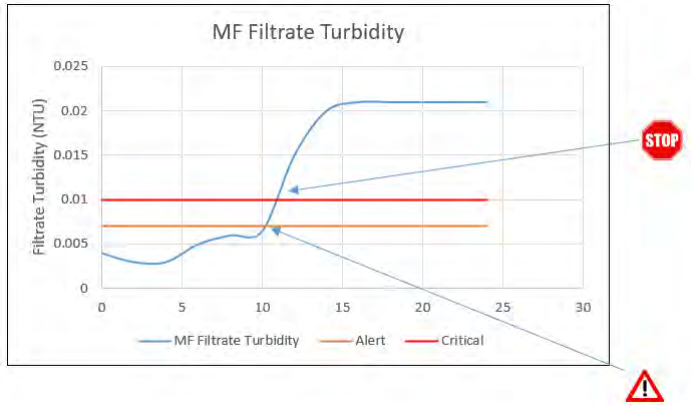
Laboratory

- Management
- High end sampling, low detections
- Coordination with online analyzer performance
- Turn around times
- Staffing
- Source to tap notifications

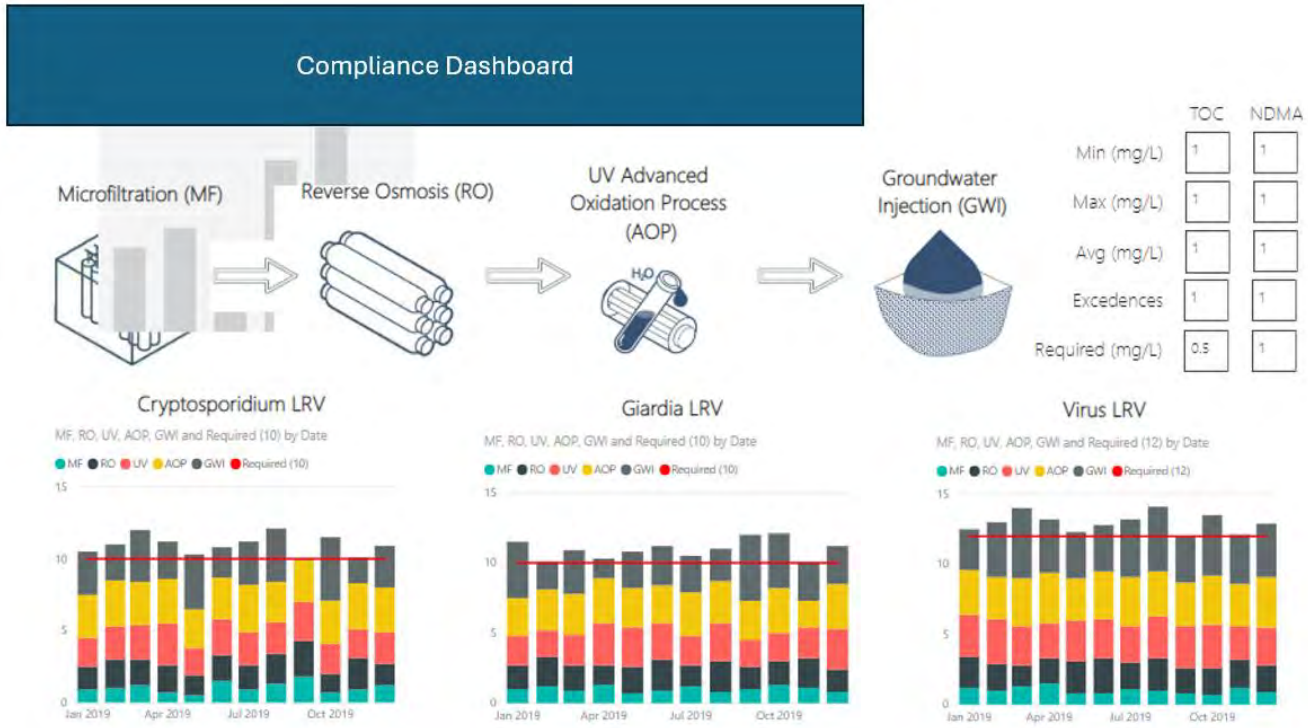
Data Coming at you – left, right and center

Data Management

- Regulatory and compliance, performance, maintenance, asset, business performance
- What's critical, what's not?



- Data storage
- Data protection
- Data trending for effective and timely decisions



Operations staff carry a heavy load

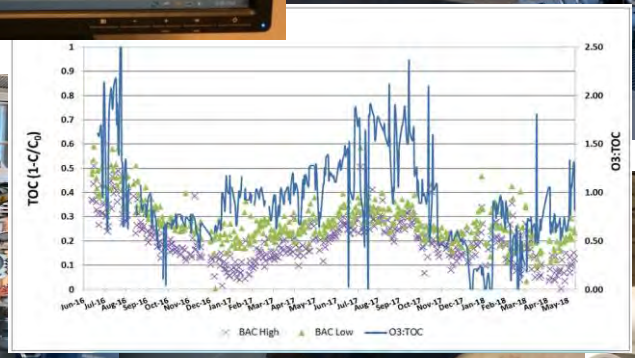
Staffing

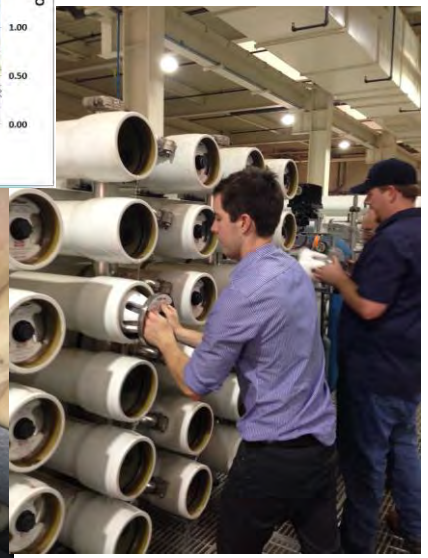
There is a lot to know and understand:

- Wastewater knowledge
- Water treatment knowledge
- Advanced process knowledge (MF, RO, UV AOP, GAC)
- Regulations, Sampling, Analysis

There are different focus areas:

- Protecting public health
- Trending, Optimizing and Improving Cost
- Maintenance
- Training
- Public Perception





There is a limited workforce. (US EPA)

Developing a team with the right skills

Operator Training and Certification

Fundamental Understanding

Hands On Experience

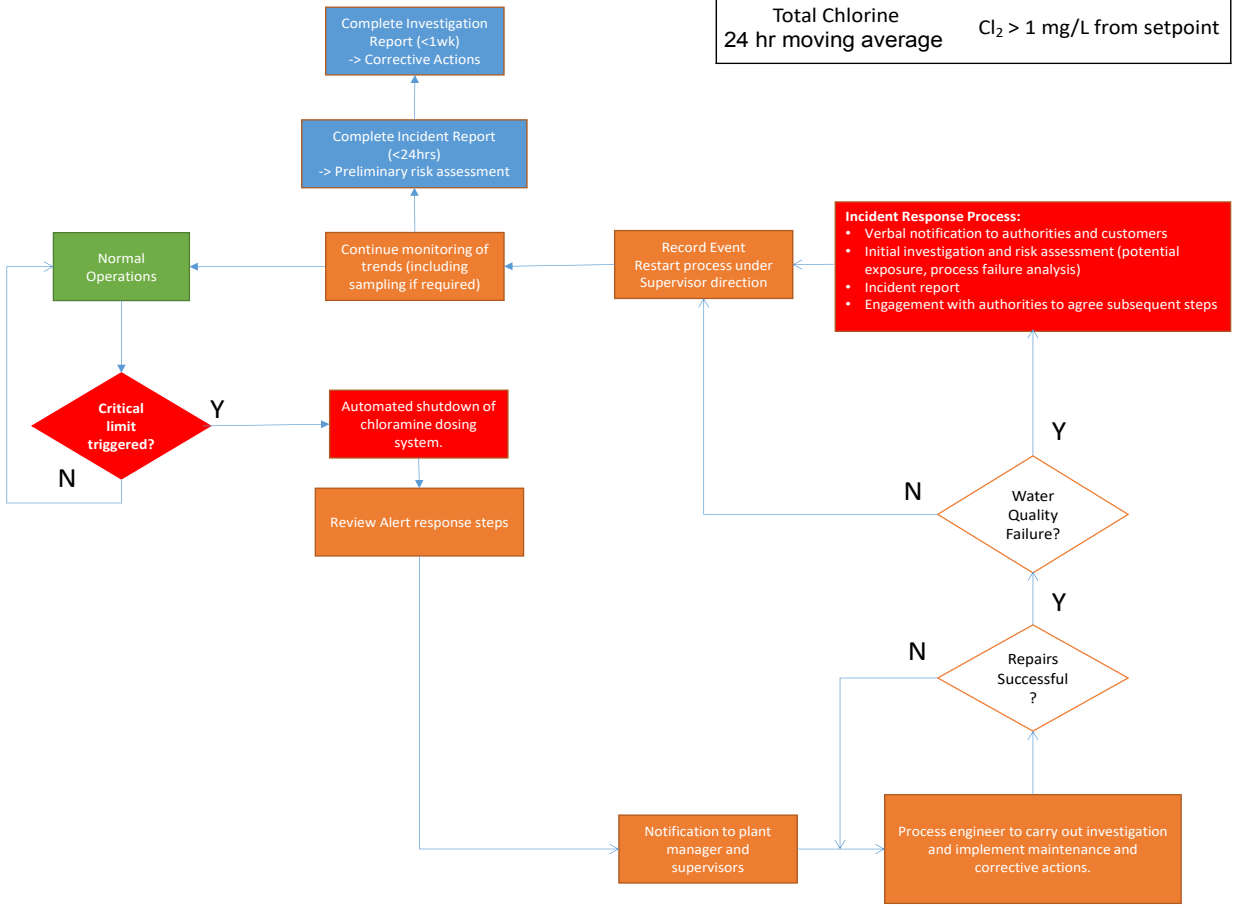
Emergency Response Procedures

Emergency Response Procedures

- CCP Corrective Action
- Emergency Response Procedures
- Training and Simulation
- Testing of Alarms and Actions
- SOPs

- Summary dashboard focused on CCPs

Parameter	Critical limit
Total Chlorine 24 hr moving average	Cl_2 > 1 mg/L from setpoint



Importance of Collaboration for IPR and DPR

- Mindset of flow regimes Wastewater vs Drinking water
  - **Flow in (Wastewater)**
  - **Product (Water)**
- Water Quality and adjustments have follow on affects
- Source Control
- Selection of processes that work complementary
- Training and Understanding
- Communication

Thankyou

Nathan Boyle, PE

Hazen and Sawyer

nboyle@hazenandsawyer.com

Transforming Southern California's Water Future

WateReuse LA/OC Chapter Summit

October 8, 2024

Surendra Thakral, PE, BCEE
Chelsea Jiang, PE

Delivering a better world

aecom.com

Transforming Southern California's Water Future

East County Advanced Water Purification

East County AWP
East County JPA

- One of the largest PDB projects involving AWT and potable reuse
- Likely to be one of the first surface water augmentation project in operation
- AWT facilities, pump stations, transmission mains
- Maximizing water recovery (95%) with primary and secondary RO

AECOM and W. M. Lyles Joint Venture

PUREWATER SOUTHERN CALIFORNIA

Pure Water Southern California
Metropolitan Water District / LACSD

- Development of pure water for IPR and DPR purposes
- 150 mgd AWT facility at A.K. Warren Water Resources Center
- Upgrade and improvement at Warren Facility for MBR/Pretreatment
- Conveyance pipelines
- Applying for grant/loan funding opportunities
- Implementation by conventional and PDB modes of delivery

AECOM and B&C Joint Venture for Program Management

PURE WATER LOS ANGELES

Hyperion Resilient Source Water for PWLA - Grassroot Upgrades and Improvements
LASAN

"Reliable and resilient for pure water – Dr. Huub Cox, LASAN"

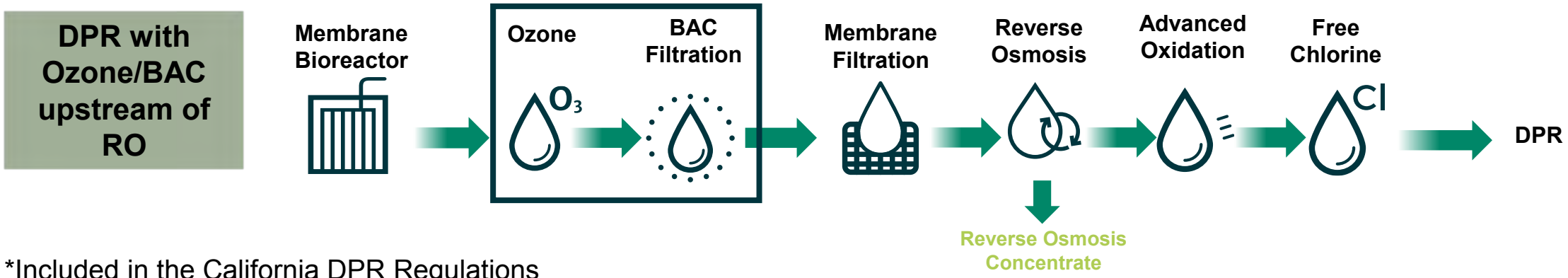
- Hyperion WRP Resiliency and Vulnerability Mitigation Plan
- Acute toxicity and ammonia work plan, ocean outfall and effluent pump station evaluation.
- Critical review of Ozone/BAC performance and benefits

AECOM Leading Several LABOE and LASAN Task Orders

Ozone/BAC Design and Construction Guidelines for Direct Potable Reuse

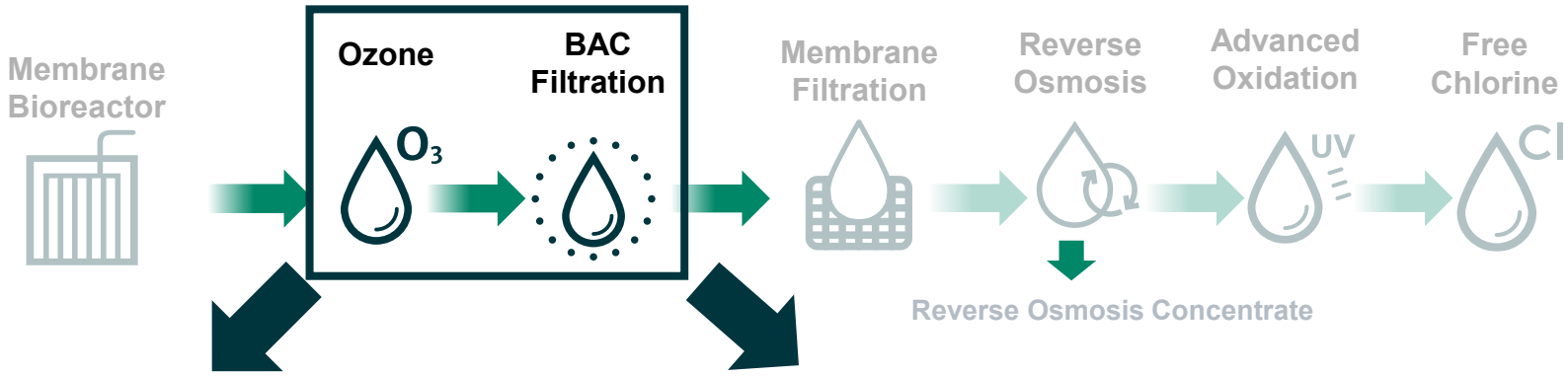
California DPR Treatment Train

Addition of Ozone/BAC to California IPR Treatment Train for DPR



*Included in the California DPR Regulations

Ozone/BAC Treatment Processes Overview



Ozonation

Oxidation of refractory organic chemicals to biodegradable chemicals

Treatment Mechanisms: Direct Ozone Molecular Oxidation and Hydroxyl Radical Advanced Oxidation Process (AOP, more pronounced with addition of peroxide)

Biologically Activated Carbon (BAC)

Biodegradation of organic chemicals. Limited adsorption of certain organics and heavy metals.

Treatment Mechanisms: Adsorption and Biodegradation (Mainly available only during conversion of GAC to BAC)

- Granular Activated Carbon (GAC) is used as filter media. Media replaced every 5-7 years

Ozone/BAC – A Proven Advanced Water Treatment Technology

Has been utilized in potable reuse applications in the US since 1985:

- Fred Hervey Water Reclamation Plant, El Paso, TX
- Gwinnett County DWR, GA

Ozone/BAC-based AWT is being planned/designed/constructed in the US:

- As the main treatment strategy in projects such as HRSD and OneWater Nevada projects

OneWater Nevada Program

Hampton Roads Sanitation District

Facility Name	Year of Ozone-Biofiltration Commissioning	Location	Upstream Treatment Steps Prior to Ozone-Biofiltration
Fred Hervey Water Reclamation Facility	1985	El Paso, Texas	Secondary treatment with PAC, lime coagulation, and sand filtration
Goreangab Water Reclamation Plant	2002	Windhoek, Namibia	Secondary treatment, pre-ozonation, PAC, chemical precipitation, DAF, dual media filtration, ozonation, BAC, GAC, UF, disinfection, and stabilization
F. Wayne Hill Water Resources Center	1999	Gwinnett County, Georgia	Secondary treatment, coagulation, and membrane filtration
San Diego Pure Water Demonstration Facility	2011	San Diego, California	Secondary treatment
Eastern Treatment Plant	2013	Melbourne, Australia	Secondary treatment
Hamby Water Reclamation Facility	2015	Abilene, Texas	Membrane bioreactor (MBR)
Cabezon Water Reclamation Facility	2017	Rio Rancho, New Mexico	Membrane bioreactor (MBR)
Neugut WWTP	2018	Dübendorf, Switzerland	Secondary treatment
HRSD SWIFT Research Center	2018	Suffolk, Virginia	Secondary treatment

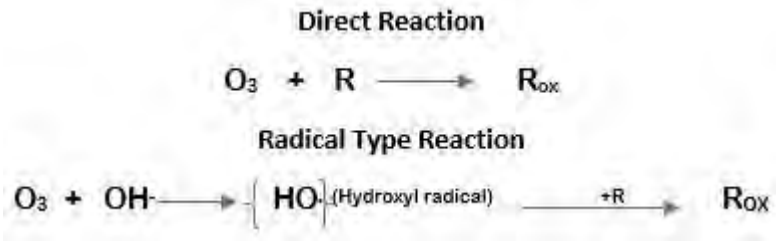
Ozone Oxidation

Purpose

Oxidation of bulk organics, CECs and pathogen reduction

Ozonation Mechanisms

- Conventional Ozonation (No hydrogen peroxide addition):
  - Direct Molecular Ozone Oxidation
  - Hydroxyl radicals (*•OH*) are generated to a lower extent.
- Ozonation with peroxide addition:
  - Hydroxyl radicals (*•OH*) facilitated oxidation becomes the dominant mechanism.
  - However, lower ozone residual results in less contact time.
  - Ozone/Peroxide application:
    - For 1,4 dioxane removal
    - For bromate mitigation



Ozone Dose

- Specific ozone dose – Transferred Ozone : [TOC +Nitrite]
- DPR regulations require an Ozone to TOC ratio greater than 1
- Ozone dose to be optimized based on site-specific factors during pilot testing.

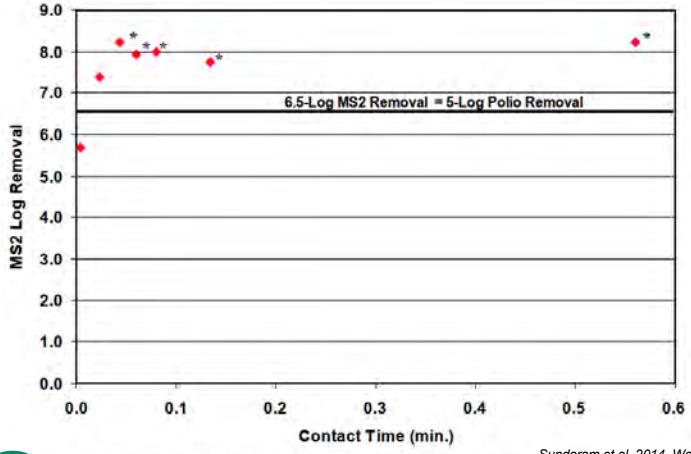
Ozone:[TOC +NO2-] (Typical range for CEC oxidation)	Reference
0.6 – 0.9	(WRF 4832 report, 2022) (WRF 4776 report, 2022)
> 1	**(California DPR Regulations)**

Ozone Disinfection

- Currently being determined based on EPA CT table
- Highly effective for inactivating Virus and Giardia
- Requires higher CT values for Cryptosporidium inactivation
- Other considerations
  - Temperature impacts
  - Ozone with peroxide requires a non-CT disinfection framework

V

MS2 Bacteriophage (Virus Surrogate) Inactivation across Ozonation



* Datum indicates complete inactivation of all viruses added.

Sundaram et al. 2014, Water Environment Research

G

Giardia Log Inactivation	Water Temperature (°C)					
	≤ 1	5	10	15	20	25
0.5	0.48	0.32	0.23	0.16	0.12	0.08
1	0.97	0.63	0.48	0.32	0.24	0.16
1.5	1.5	0.95	0.72	0.48	0.36	0.24
2	1.9	1.3	0.95	0.63	0.48	0.32
2.5	2.4	1.6	1.2	0.79	0.60	0.4
3	2.9	1.9	1.43	0.95	0.72	0.48

Code of Federal Regulations, 40 CFR 141.720. (2006)

C

CT Values

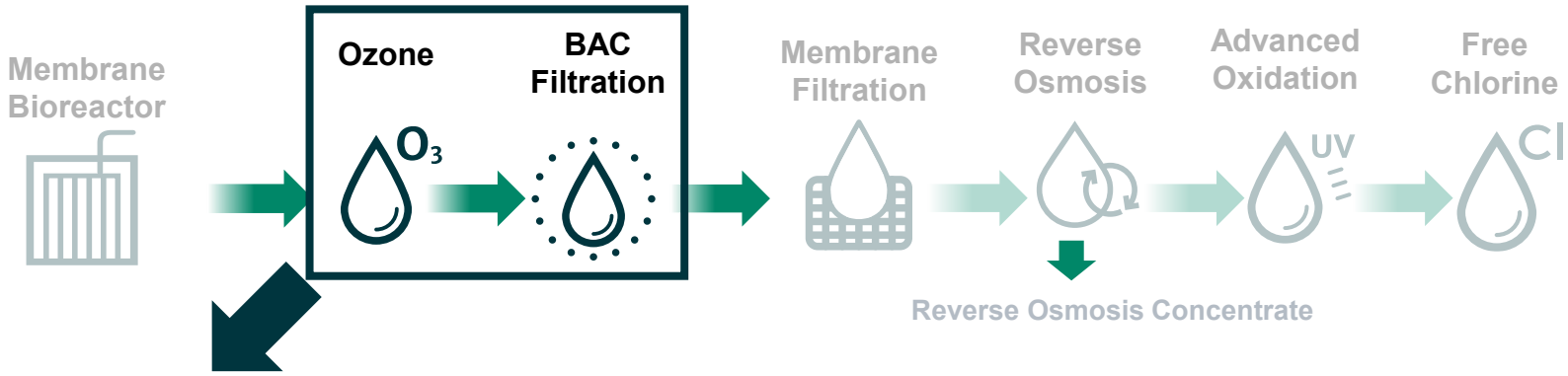
Cryptosporidium Log Inactivation	Water Temperature (°C)										
	≤ 0.5	1	2	3	5	7	10	15	20	25	30
0.25	6	5.8	5.2	4.8	4	3.3	2.5	1.6	1	0.6	0.39
0.5	12	12	10	9.5	7.9	6.5	4.9	3.1	2	1.2	0.78
1	24	23	21	19	16	13	9.9	6.2	3.9	2.5	1.6
1.5	36	35	31	29	24	20	15	9.3	5.9	3.7	2.4
2	48	46	42	38	32	26	20	12	7.8	4.9	3.1
2.5	60	58	52	48	40	33	25	16	9.8	6.2	3.9
3	72	69	63	57	47	39	30	19	12	7.4	4.7

Code of Federal Regulations, 40 CFR 141.720. (2006)

Other Key Topics for Ozonation

- Assessment of Influent Water Characteristics
- Ozone Contact Time and Contactor Design
- Ozone Byproducts and Mitigation Strategies
- Online Monitoring and Critical Control Points
- Equipment Selection and Sizing Considerations
- Off-Gas Collection and Destruction
- System Redundancy

Ozone/BAC Treatment Processes Overview



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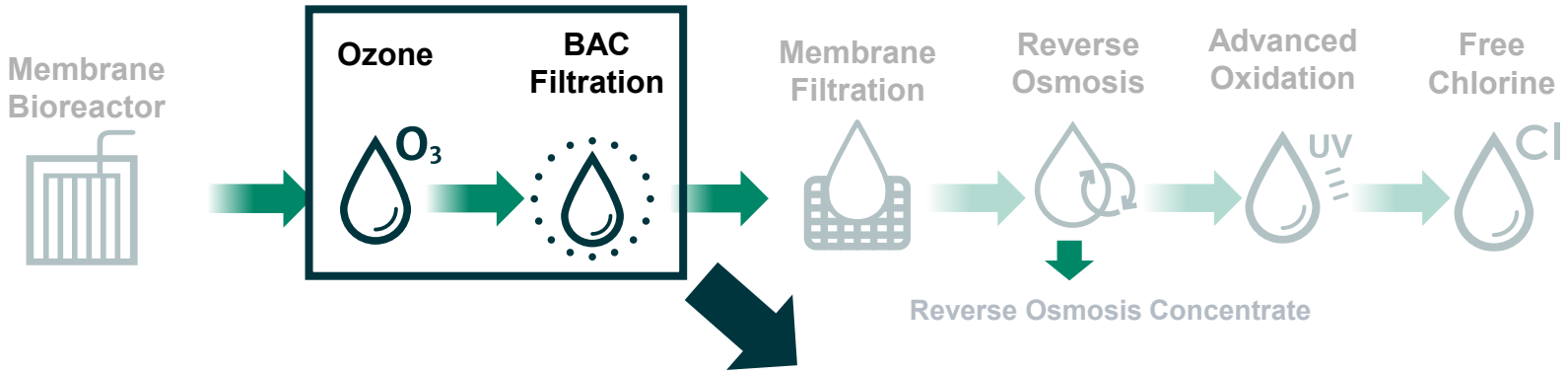

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Treatment Mechanisms: Adsorption and Biodegradation (Mainly available only during conversion of GAC to BAC)

- Granular Activated Carbon (GAC) is used as filter media. Media replaced every 5-7 years

Purpose of BAC/BACF

- **Chemical Control**:
  - Removal of low molecular weight compounds and other biodegradable organics.

- **Potential Pathogen Control**:
  - Additional testing and validation are necessary to demonstrate pathogen log reduction values (LRVs) in BAC

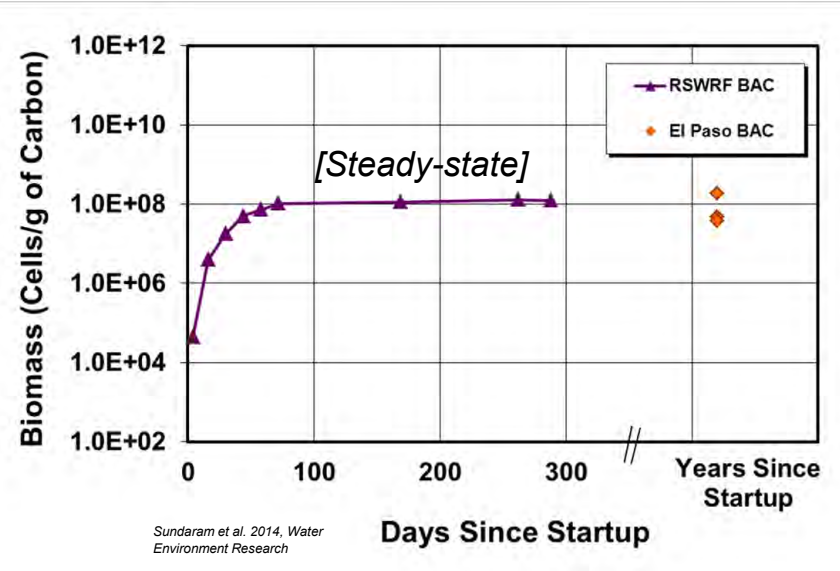
BAC Empty Bed Contact Time (EBCT)

EBCT	Conditions	Reference
≥ 15 minutes	**Different EBCT may be used if at least 1-log reduction for indicators (formaldehyde and acetone) is demonstrated.**	**California DPR Regulations**
10 minutes - 20 minutes	Ozone-BACF is being utilized as a pretreatment of RO Ozone-BACF is the primary barrier for CECs	Ozone-Biofiltration Design and Operational Considerations for Potable Reuse Projects (Sundaram, 2018)

BACF Start-up/Acclimation

– The acclimation period for BAC with fresh GAC is typically around three – six months for transitioning from adsorption to biodegradation as the dominant removal mechanism:

- Transition period: Adsorbable CECs such as PFAS are removed based on available GAC adsorption capacity.
- Steady-state operation: Biological treatment is effective for the removal of NDMA and aldehydes



Sundaram et al. 2014, Water Environment Research

Other Key Topics for BAC

- Assessment of Influent Water Characteristics
- Media selection
- Filter Configuration
- Backwash Regime and Headloss
- Online monitoring and Critical Control Points
- Equipment Selection and Sizing Considerations
- Redundancy

Thank you.

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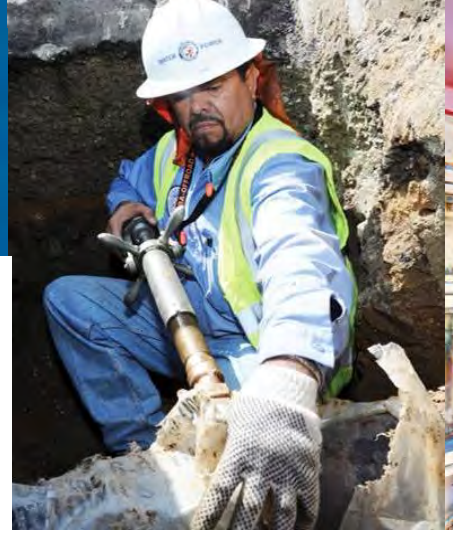

LA Groundwater Replenishment (GWR) Project Update

LA & OC WateReuse Summit
October 8, 2024

Los Angeles Department of Water & Power

LADWP – Water System

Groundwater Replenishment
Donald C. Tillman – 100% Reuse

environment LASANITATION CITY OF LOS ANGELES

LAGWR - What's the Big Deal?

Mayor Bass – Highlighting GWR (Dec. 2023)

KEY POINTS

1. LAGWR One of the Largest Projects in the State
2. Breaking Ground this November 2024
3. New Sustainable & Climate Resilient Water Supply
4. DWP & LASAN Partnership

LADWP – Water System

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Why Does This Matter?

Climate Change

Seismic Risk to Imported Supplies

Los Angeles Aqueduct

Supply reduction due to Owens Lake dust mitigation

Local Groundwater

Contamination in the San Fernando Basin

Colorado River Aqueduct

Los Angeles Department of Water & Power

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What Are We Doing to Address Challenges?

Recycle
100%
of Waste Water
by 2035

Source
70%
of all water locally
by 2035

Reduce Potable Water Use

22.5%
By 2025

25%
By 2035

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What is LAGWR???

1. **LAGWR Increases Sustainability of Our Water Supply**

2. **LAGWR Project Objectives:**
   - ✓ New Water Supply - 250,000 Angeleno's
   - ✓ Replenish the San Fernando Groundwater Basin with Purified Recycled Water

3. **Investment of $740M in Next 4 Years & $398M Secured**

4. **Start Construction in 2024 & Complete in 2027**

5. **Balance Water Supply with Environmental & Recreation**

LADWP – Water System

Groundwater Replenishment

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https://jacobs.reviewstudio.com/cube/614184063/file/7300308

LADWP – Water System

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GWR awarded $30M Title XVI Bureau of Reclamation Grant (May 2024)


EPA United States Environmental Protection Agency

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EPA Announces $224 Million Water Infrastructure Loan for Climate Resilience in Los Angeles

Nationally, 60 WIFIA loans are financing over $25 billion in water infrastructure upgrades, creating 71,000 jobs

SIGNIFICANT SUPPORT FOR LAGWR

- **Total Capital Cost: $740M**
- **Funding Secured: $398M**
  - WIFIA - $224M Loan
  - SWRCB - $5M Grant
  - MWD LRP - $139M Grant
  - Bureau of Rec. - $30M Grant
- **California Water Board**

LADWP – Water System

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Scope of GWR – Major Improvements

Electrical, Maintenance, and Warehouse Facilities

EQ Tank, AWPF

ADVANCED TREATMENT FACILITY & LEARNING CENTER

EQUILIZATION TANKS (8 MG STORAGE)

LADWP – Water System

Groundwater Replenishment
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FINAL POINTS

1. Milestone Achievement for LADWP
2. Groundbreaking Ceremony in November 2024
3. Complete by 2027
4. Celebrate!!!

Hazen Woodard & Curran Jacobs Trussell Technologies Inc carollo

LADWP – Water System

Groundwater Replenishment
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