Clearway Community Energy

San Francisco

Groundwater Reclamation Project – Lessons Learned

IDEA Toronto – June 2022

Presented by Gordon Judd, General Manager
Energy Center San Francisco

How Much is 80 Million Gallons?

- Enough Water to Fill the Largest Oil Tanker that Can Go Through the Suez Canal

How Much is 80 Million Gallons?

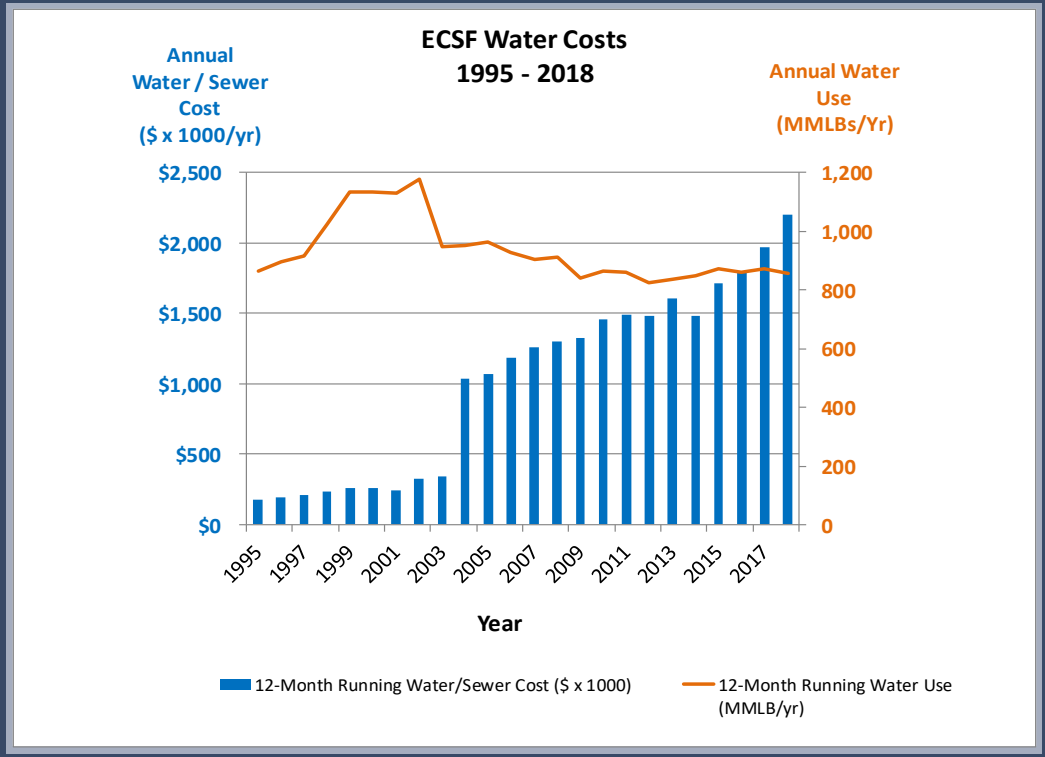
- Over 1,000 Miles of 55-gal Drums Lying End-to-End

How Much is 80 Million Gallons?

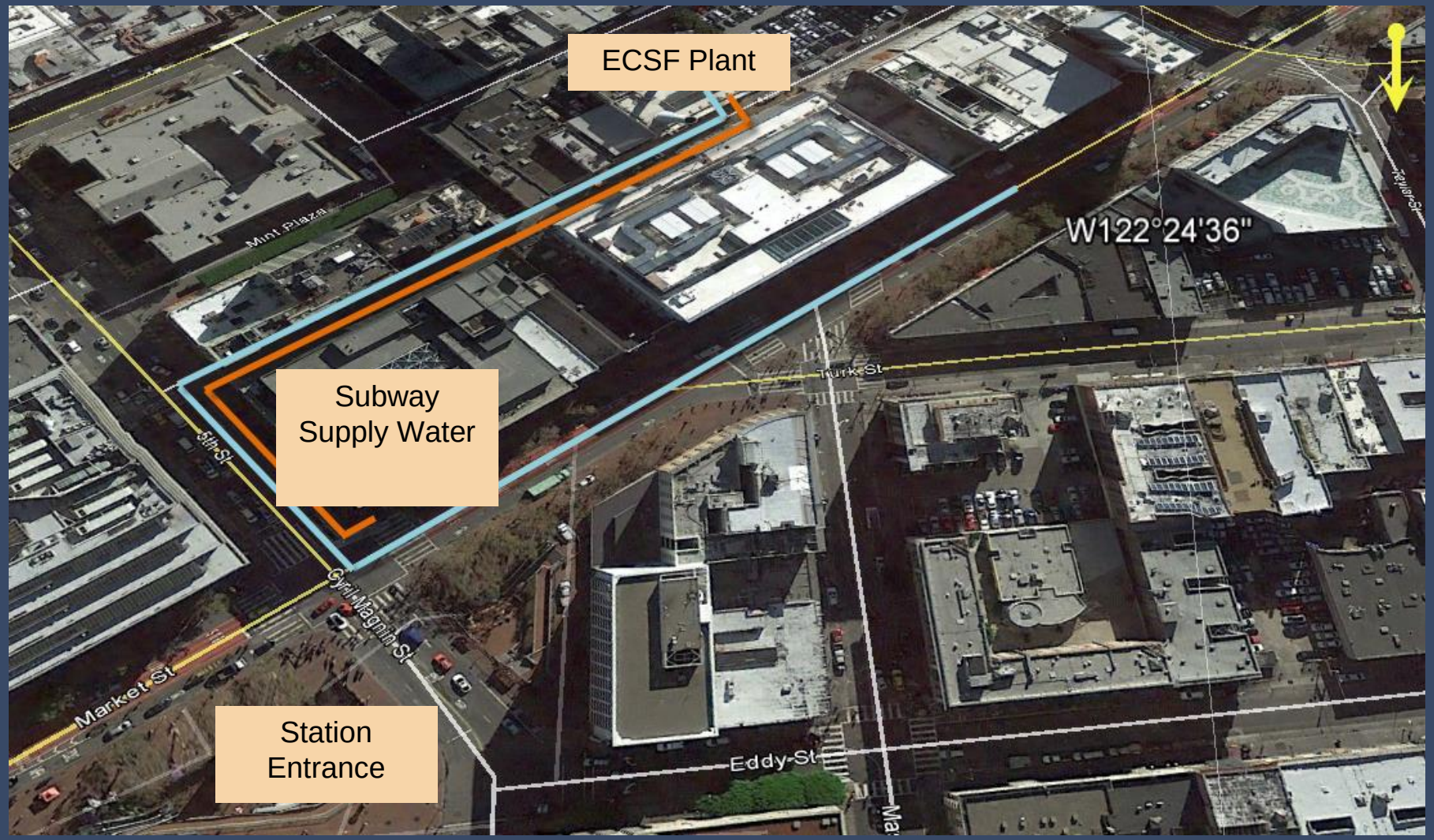
- The amount of Groundwater that Energy Center San Francisco hoped to harvest for boiler makeup water.

The Opportunity

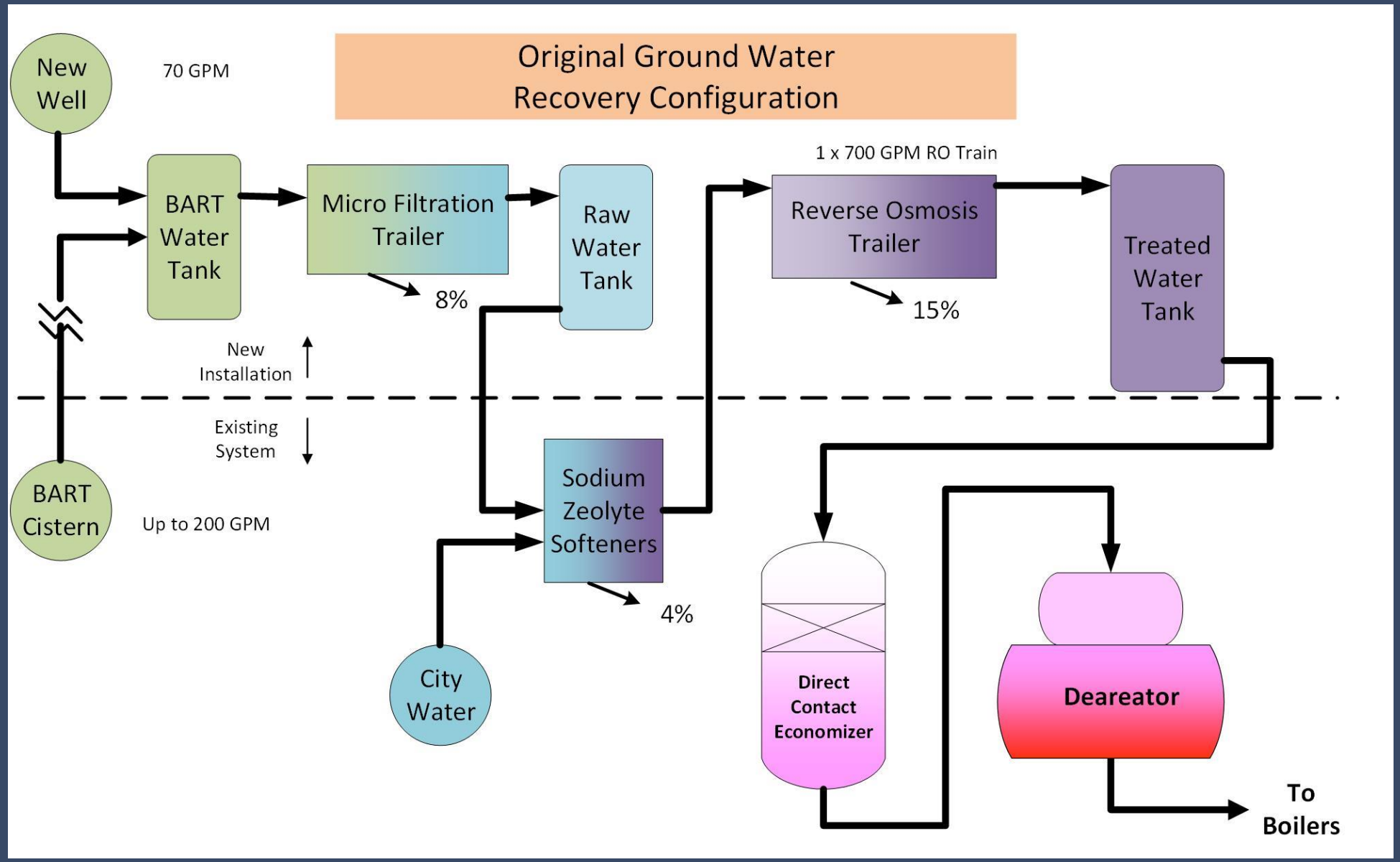
- The Powell St. Subway Station is 2 blocks from ECSF and disposes of over 30 Mgal of ground water intrusion per year.
- The San Francisco Public Utilities Commission water reuse projects and is offering up to $500k grants for Water Reuse Projects.
- Energy Center San Francisco Water/Sewer Costs have increased 8X in 14 Years.



The Execution – Pipeline



Original Design



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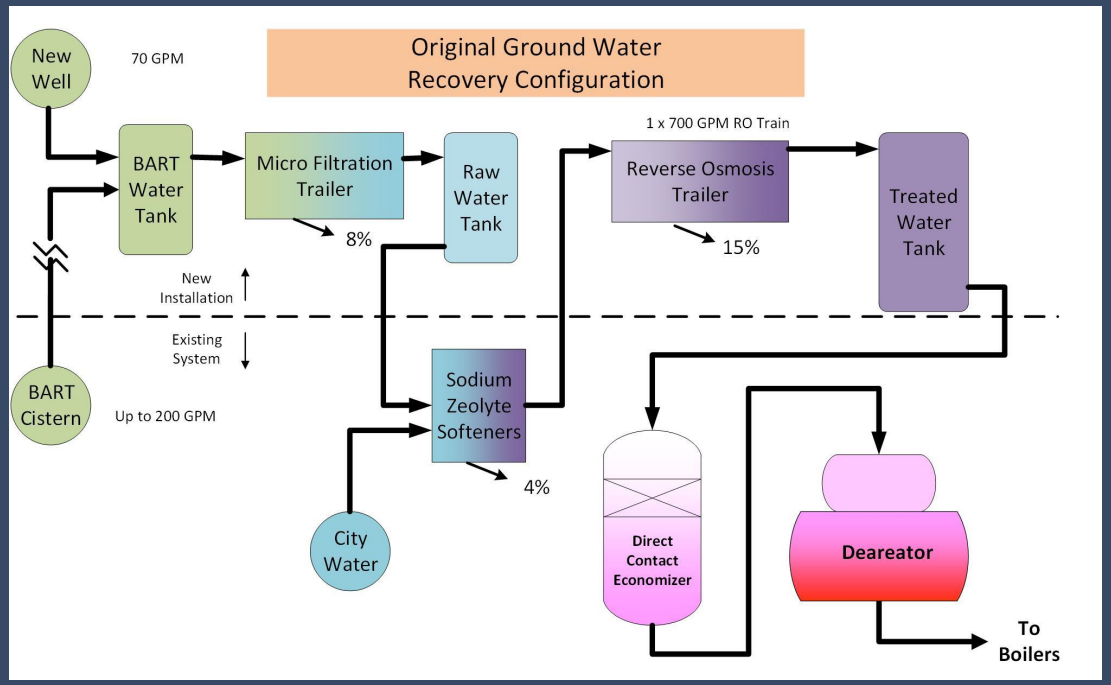
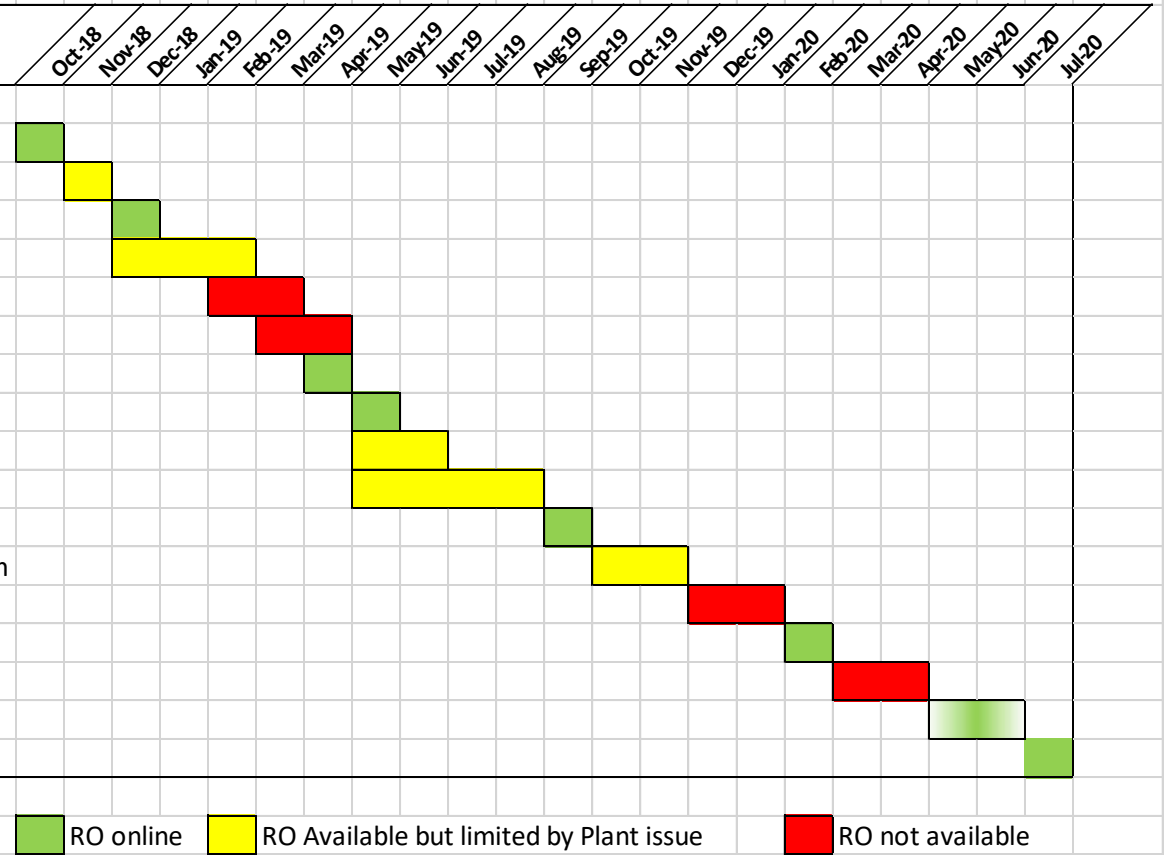


- BART & Well water through Micro-Filtration
- BART, Well & City water through Softeners
- BART, Well, & City water through Reverse Osmosis Using Desalitech Process
- Goal: Consistent water quality to plant at all times.

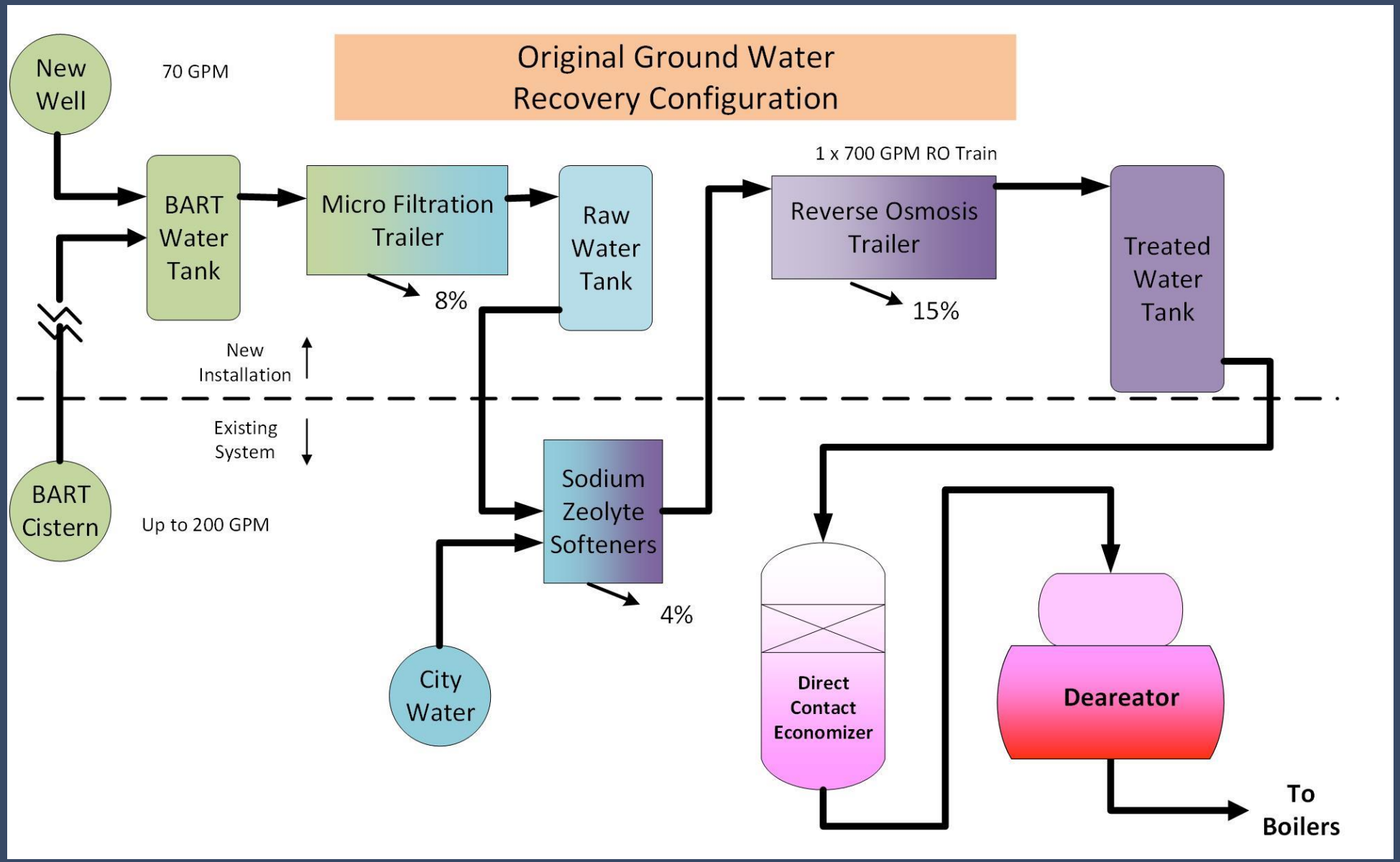
Operational History 2018-2020

ECSF RO Operational History

Operational Status	Specific Problem
Intermittent	Commissioning
Off	Electric Tripping of Cogens
Online	none
Intermittent	Electric Islanding of Plant
Off	MF inlet Strainers plugging
Intermittent	Water Hammer in RO
Online	none
Intermittent	Treated Water Pump Brng Failure
Intermittent	Well pump failure
Intermittent	Load Bank failure
Online	RO Running but minimal savings
Off	Plant Softeners Hardness Problem
Off	RO PVC Piping Failure
Online	RO Running but minimal savings
Off	RO conductivity probe lockout
Intermittent	Complete Reconfiguration
Online	

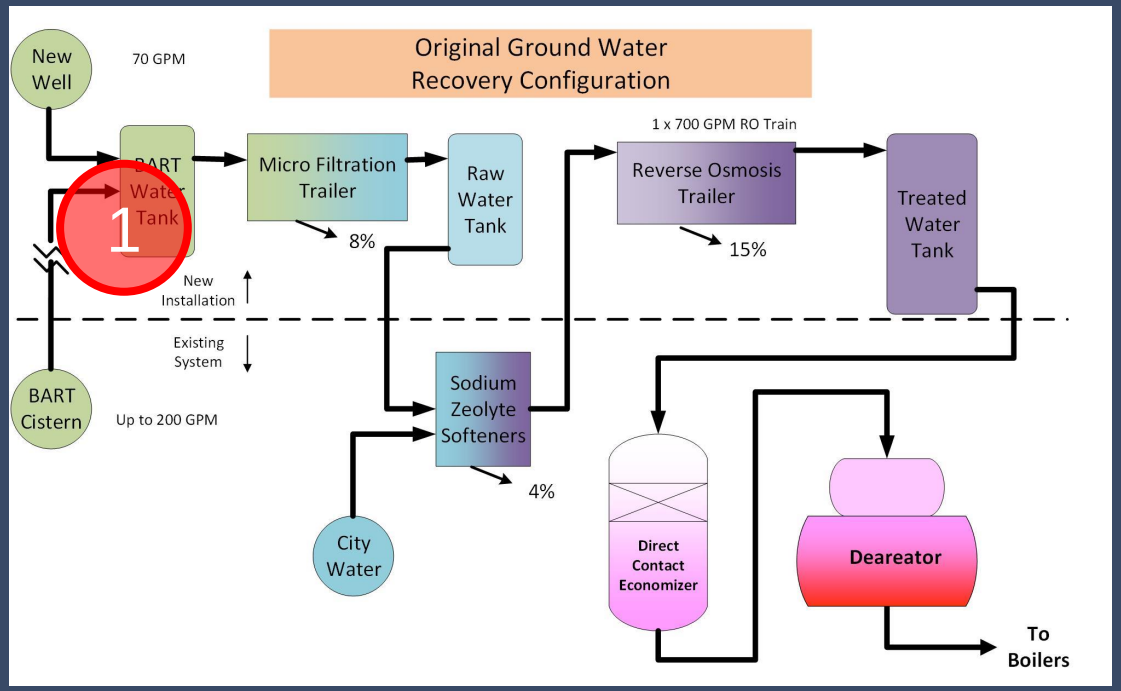


Problems


Original Ground Water Recovery Configuration
New Well
70 GPM
BART Water Tank
Micro Filtration Trailer
8%
Raw Water Tank
1 x 700 GPM RO Train
Reverse Osmosis Trailer
15%
Treated Water Tank
New Installation
Existing System
BART Cistern
Up to 200 GPM
Sodium Zeolyte Softeners
4%
City Water
Direct Contact Economizer
Deareator
To Boilers

Problems

1. BART Water Receiver clogging



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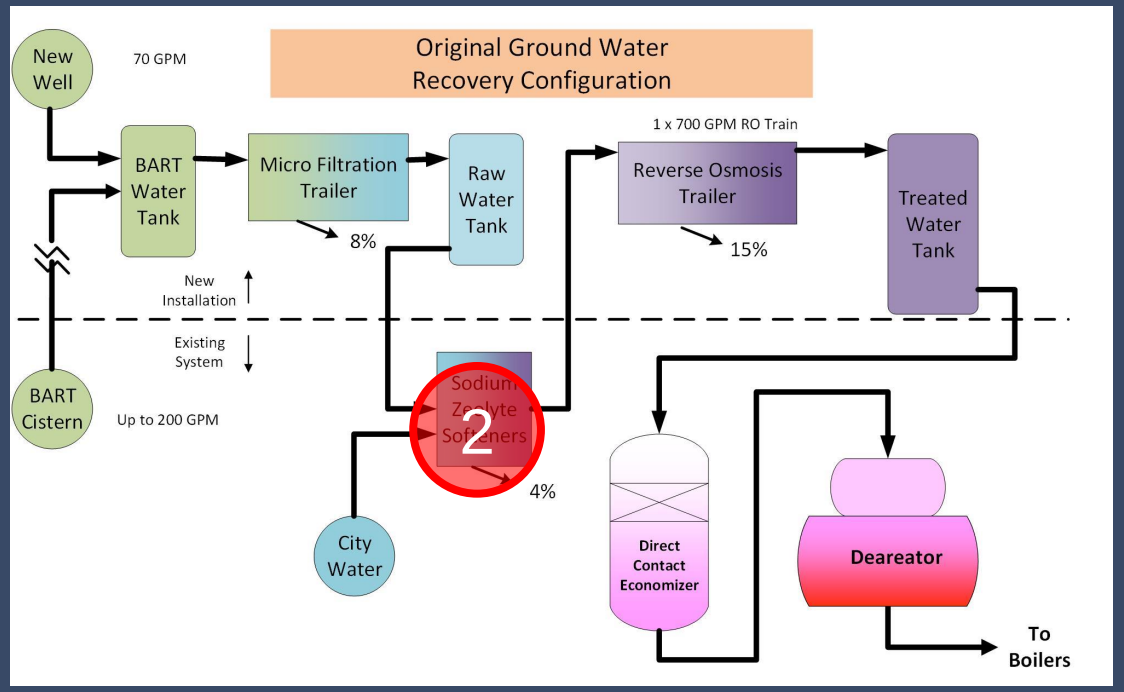
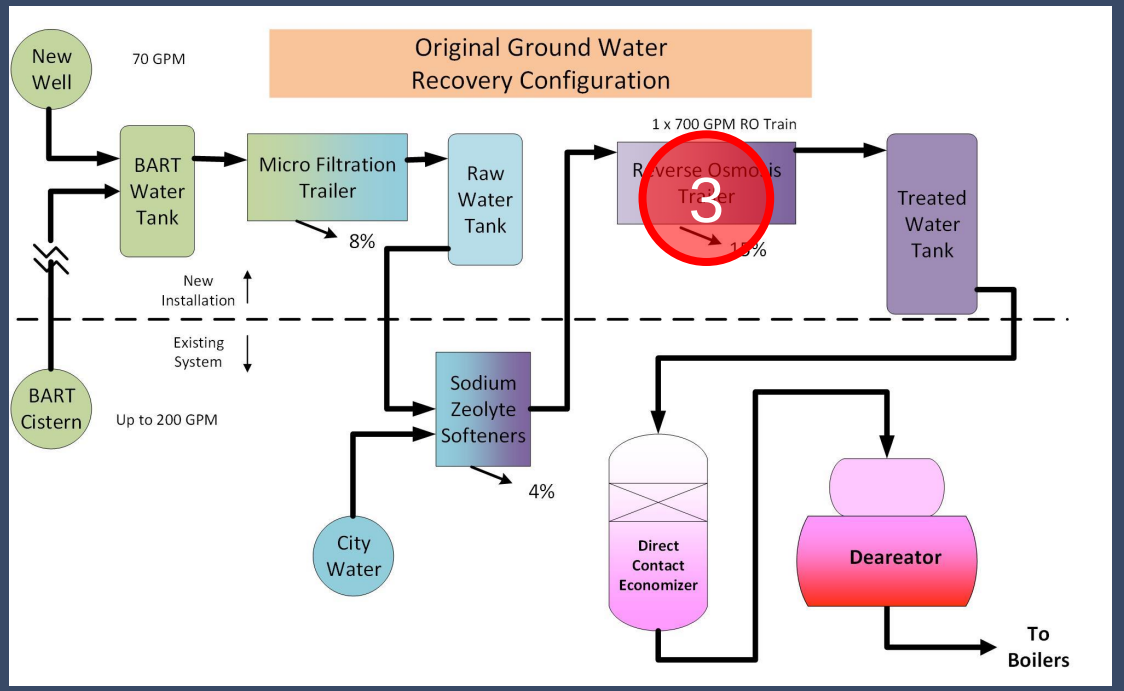


1. BART Water Receiver clogging
2. Since Groundwater goes through softeners first, very frequent regen of softeners

Problems



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3. Varying ratio between BART and City Water causes varying makeup pH to RO which leads to Silica Buildup on RO membrane

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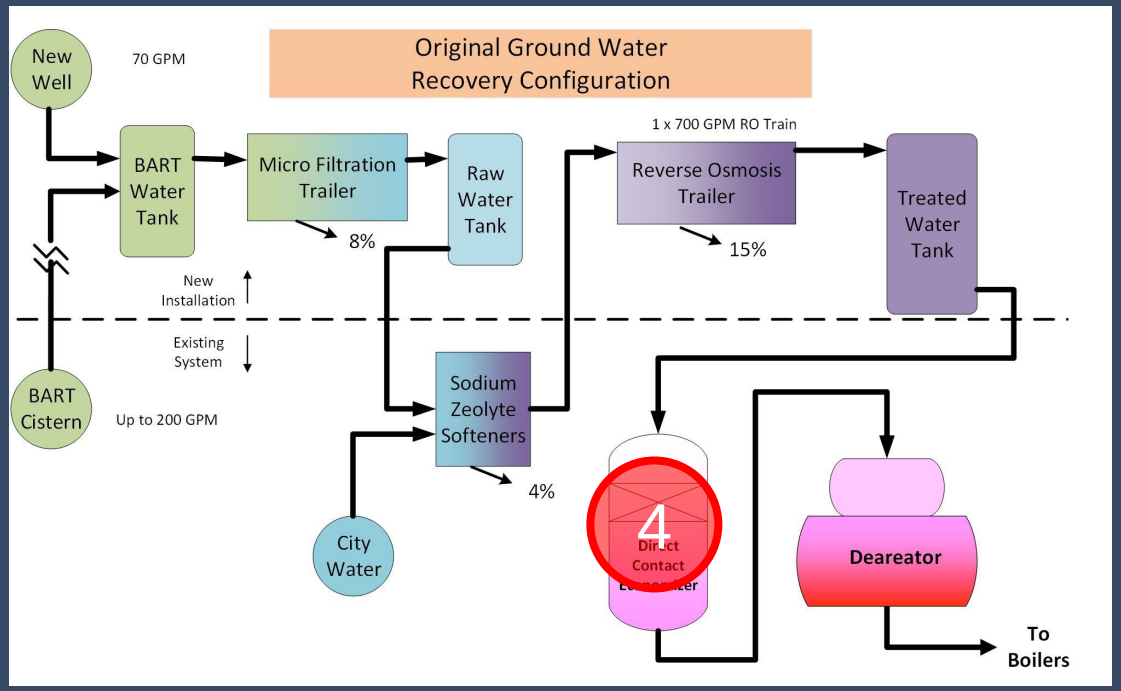

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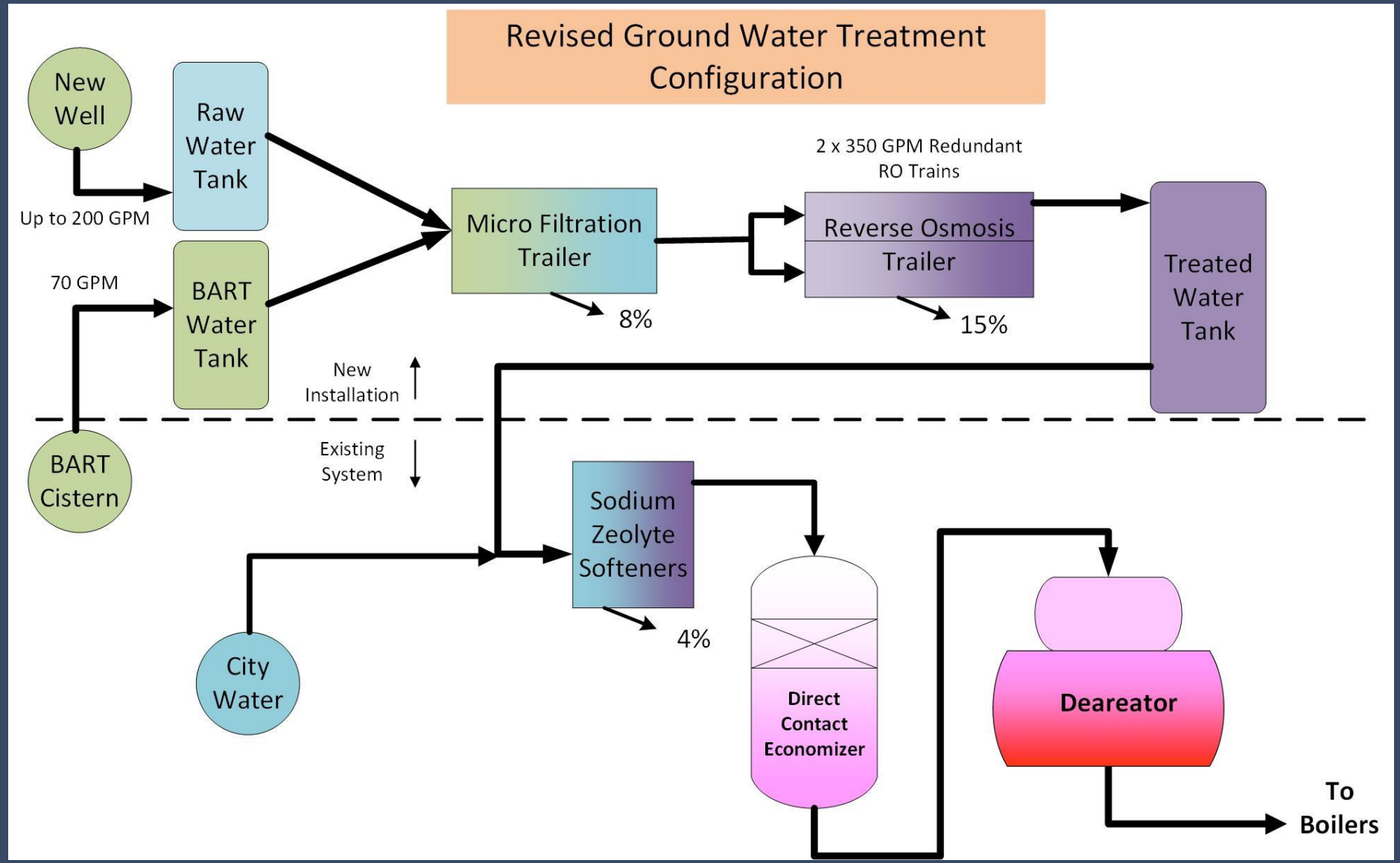
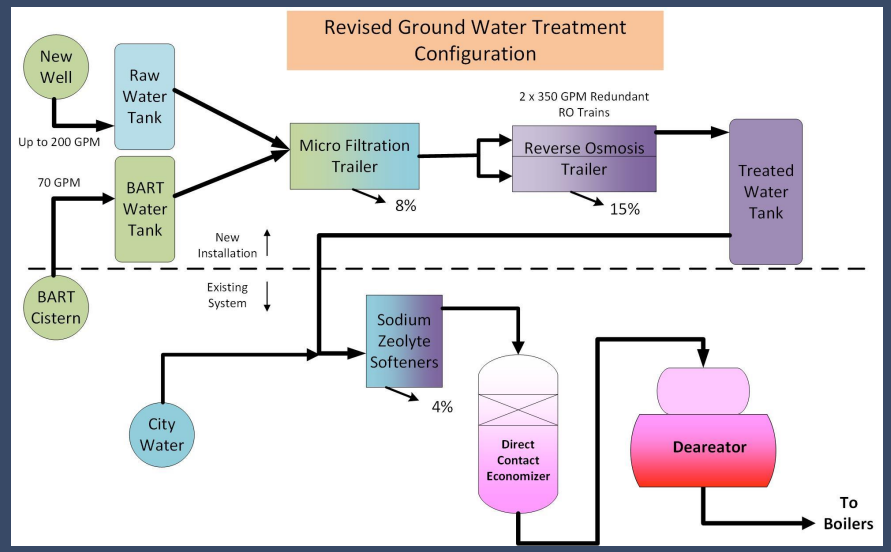
2. Since Groundwater going through Softeners first, very frequent regen of Softeners
3. Varying ratio between BART and City Water causes varying makeup pH to RO which leads to Silica Buildup on RO membrane
4. Higher CO2 absorption in Direct Contact Economizer

The Reconfiguration



Summary of Reconfiguration

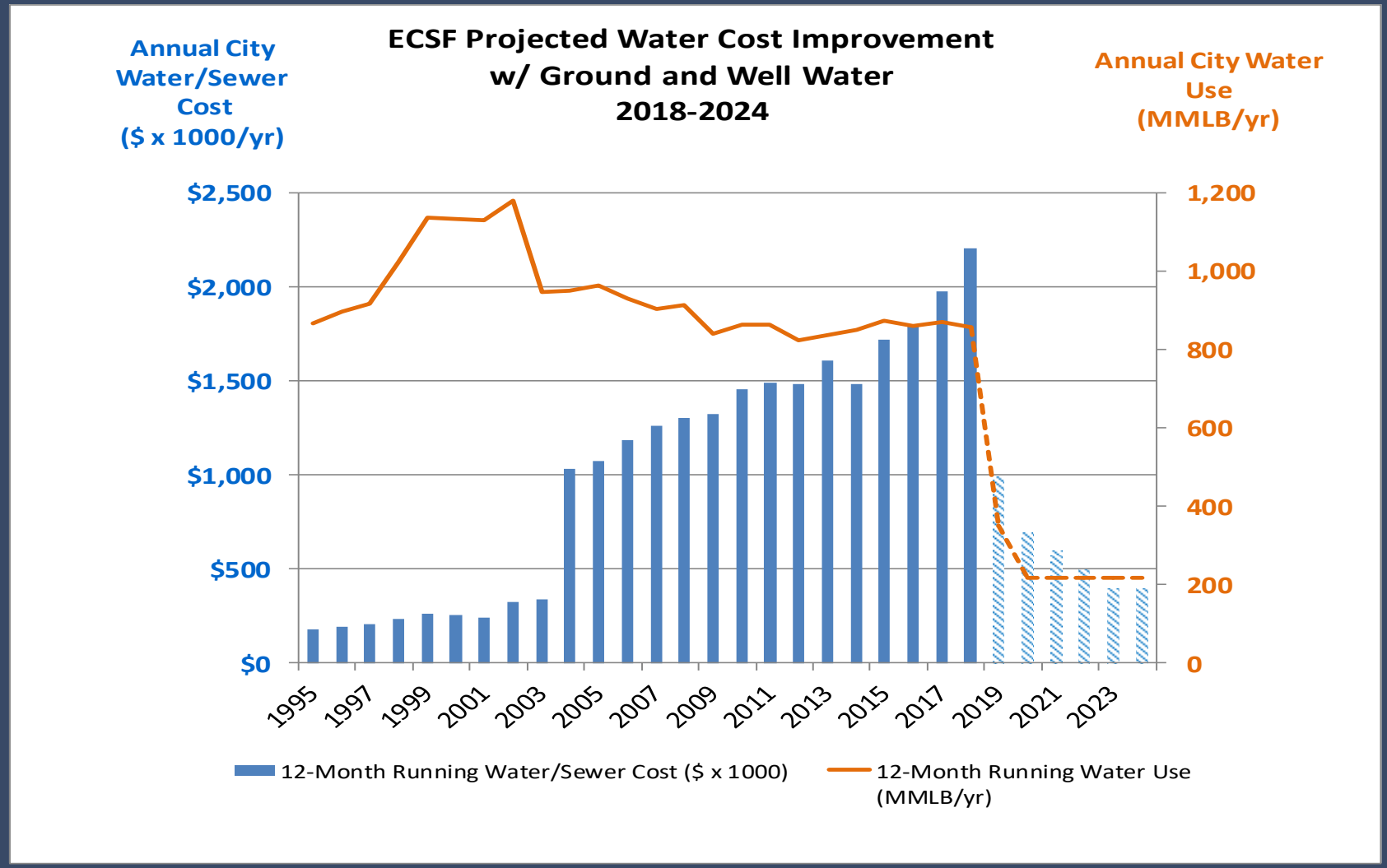


- Only BART & Well go thru MF & RO
  - Minimize discharge to Metered Sewer
  - Reconfigured RO with 2 x 350 gpm trains
- Output of RO displaces and blended with incoming City Water
- All Water then goes through softener
- Direct Contact Economizer converted to indirect contact to reduce CO_2 pickup

Summary of Operational & Economic Results

- MF Recovery is 94%
- RO Recovery is 84%
- Net Groundwater used in boilers is 75%
- Overall 98% availability
- City Water use reduced by 32M gallons per year, 44% reduction
- Water/Sewer Savings of $2200/day, over $750k/yr
- Permitting of 200 gpm well will add additional $700k/yr of savings

The Results


ECSF Projected Water Cost Improvement
w/ Ground and Well Water
2018-2024
Annual City Water/Sewer Cost ($ x 1000/yr)
Annual City Water Use (MMLB/yr)
$2,500
$2,000
$1,500
$1,000
$500
$0
1,200
1,000
800
600
400
200
0
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
2023
12-Month Running Water/Sewer Cost ($ x 1000)
12-Month Running Water Use (MMLB/yr)

Questions

Clearway Community Energy

Thank you!