

This presentation premiered at WaterSmart Innovations

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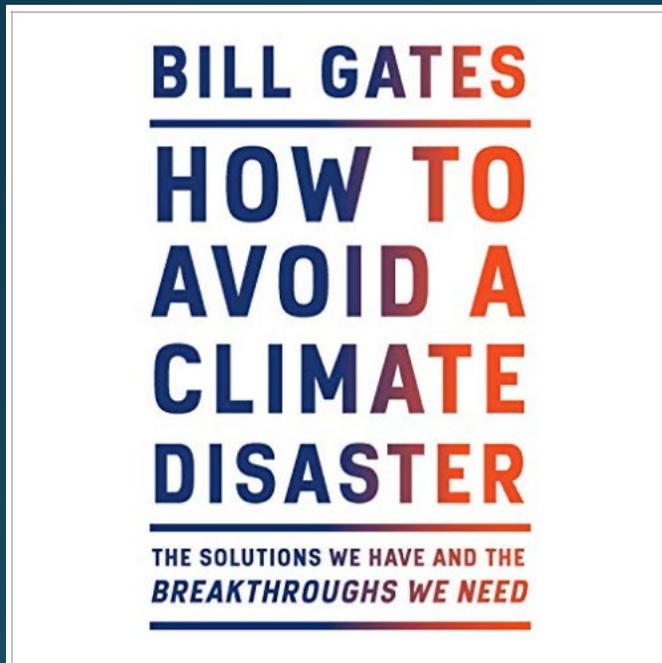
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The Green Premium of Water Recycling

What is a Green Premium?



- The cost delta between a zero carbon solution to a fossil-fuel dependent problem. (Gates 59)

Variables that affect Green Premium Calculations

- Geographic Location
- Classification of water being recycled, ie. Rain, Grey or Blackwater
- Cost of Potable Water being offset with recycled water
- Manufacturer cost variances
- Service & Maintenance Cost variances
- Installation Labor Costs
- Collection and Conveyance Piping Material Costs
- Building Sizes and Collection Locations
- Recycled Water Quality & Testing Parameters dictated by the Regional Recycled Water Authority

Narrowing it Down- Establishing the Limits of the Study

- 1. Classifications of Water to be Recycled:
 - Rainwater
 - Greywater
 - Blackwater
- 2. Ways in which the water is reused:
 - Toilet & Urinal Flushing
 - Irrigation
 - Cooling Tower Makeup Water- large buildings with excess supply only
- 3. How Clean must the water be? Says who?:
 - In 2016, the US Water Alliance, the San Francisco Public Utilities Commission and the Water Research Foundation had a baby. The baby's name is the **National Blue Ribbon Commission for Onsite Non-potable Water Systems**

NBRC for Onsite Non-potable Reuse-Water Quality Standards

Water Use Scenario	Log Reduction Targets			Required Treatment Processes	Total Coliform	BOD ₅	TSS	Turbidity	pH
	Virus	Protozoa	Bacteria						
Blackwater									
Irrigation	8.0	7.0	6.0	Oxidation, Filtration, Disinfection	2.2 CFU/100 mL	25 mg/L	30 mg/L	.5 NTU	6-10
Indoor Use	8.5	7.0	6.0						
Graywater									
Irrigation	5.5	4.5	3.5	Oxidation, Filtration, Disinfection	2.2 CFU/100 mL	25 mg/L	30 mg/L	.5 NTU	6-10
Indoor Use	6.0	4.5	3.5						
Rainwater									
Irrigation	N/A	N/A	3.5	Disinfection	2.2 CFU/100 mL	N/A	N/A	10 NTU	6-10
Indoor Use	N/A	N/A	3.5						

Calculating the Green Premium

$$\text{Cost of Water Recycling} - \text{Value of Water being Recycled} = \text{Green Premium}$$

Costs of Water Recycling

- Engineering, Manufacturing & Delivery of the Water Recycling Equipment
- Equipment Room Construction
 - Plumbing & Electrical Installation
 - Water Holding Tanks sizes, materials of construction
- Dual Collection Piping (Greywater)
- Dual Distribution Piping (Potable Water & Non-Potable Water)
- Non-Potable Distribution Pumps
- Permit Fees

Operating Costs

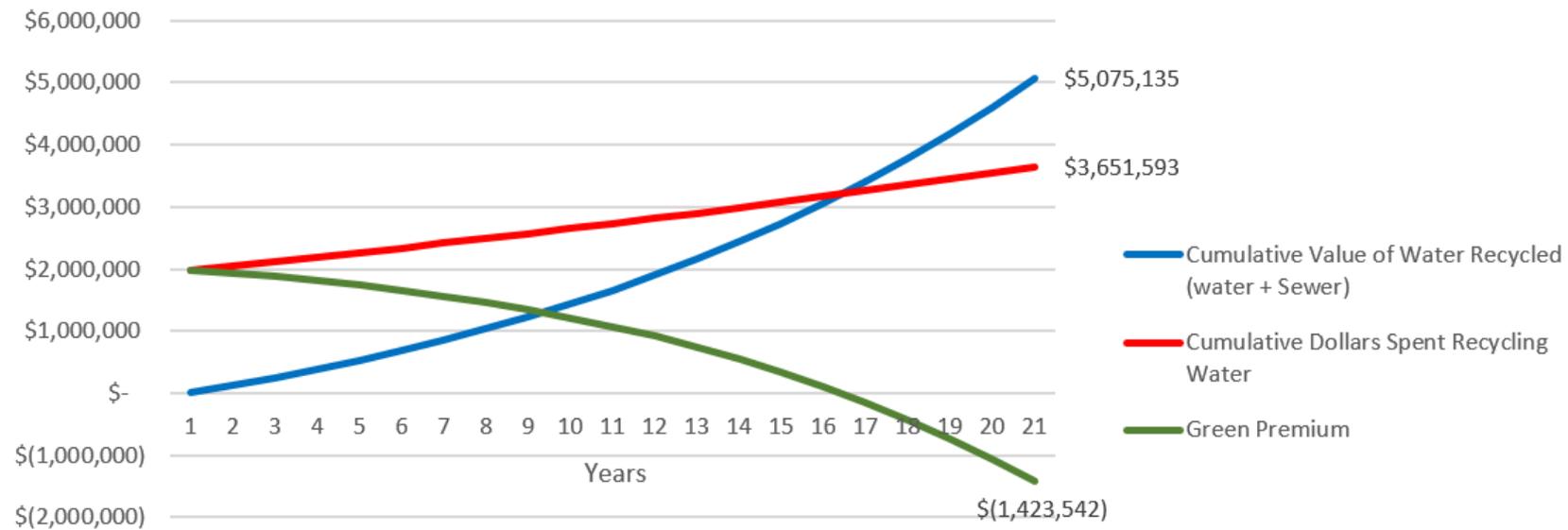
- Service & Maintenance Contract
- Electricity Consumption
- Consumables & Chemicals
- Permit Renewal Fees
- Water Sample Analysis for Regulatory Compliance

Value of Water Being Recycled

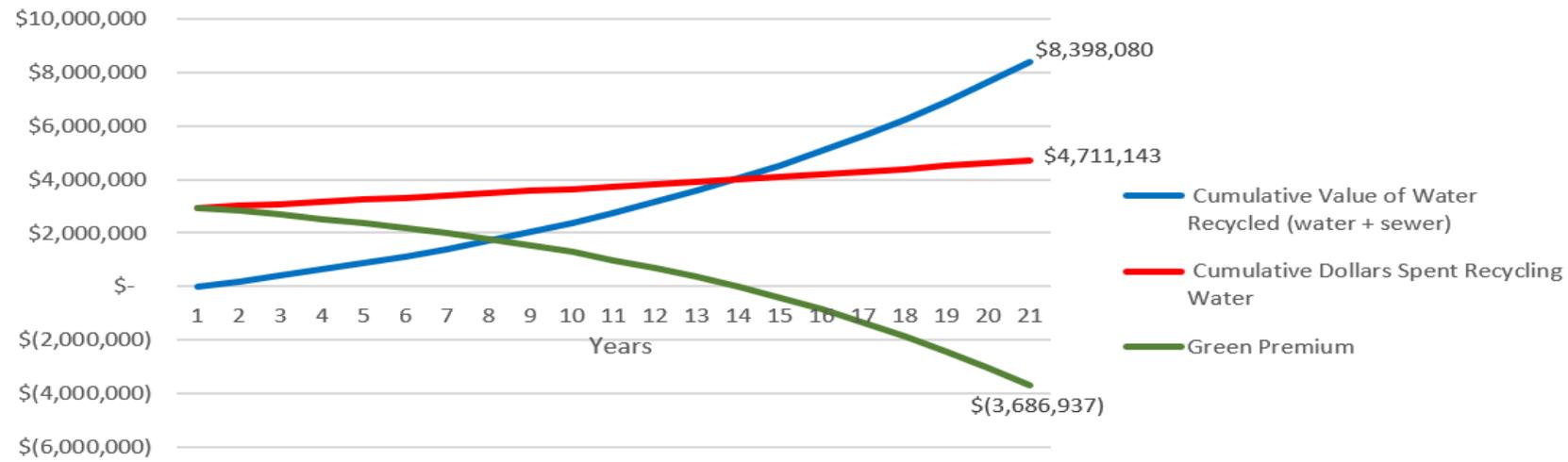
- The Cost of Potable Water by Volume
- The Cost of Wastewater Treatment by Volume

Greywater Recycling Green Premium

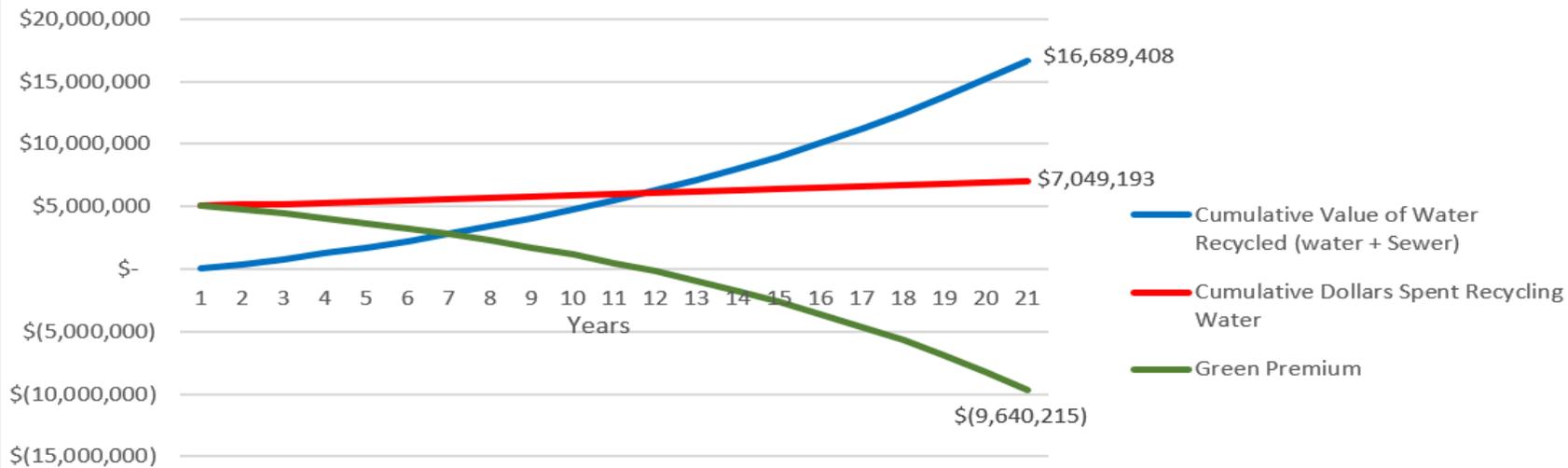
8,000 Gallons of Greywater Recycled Daily



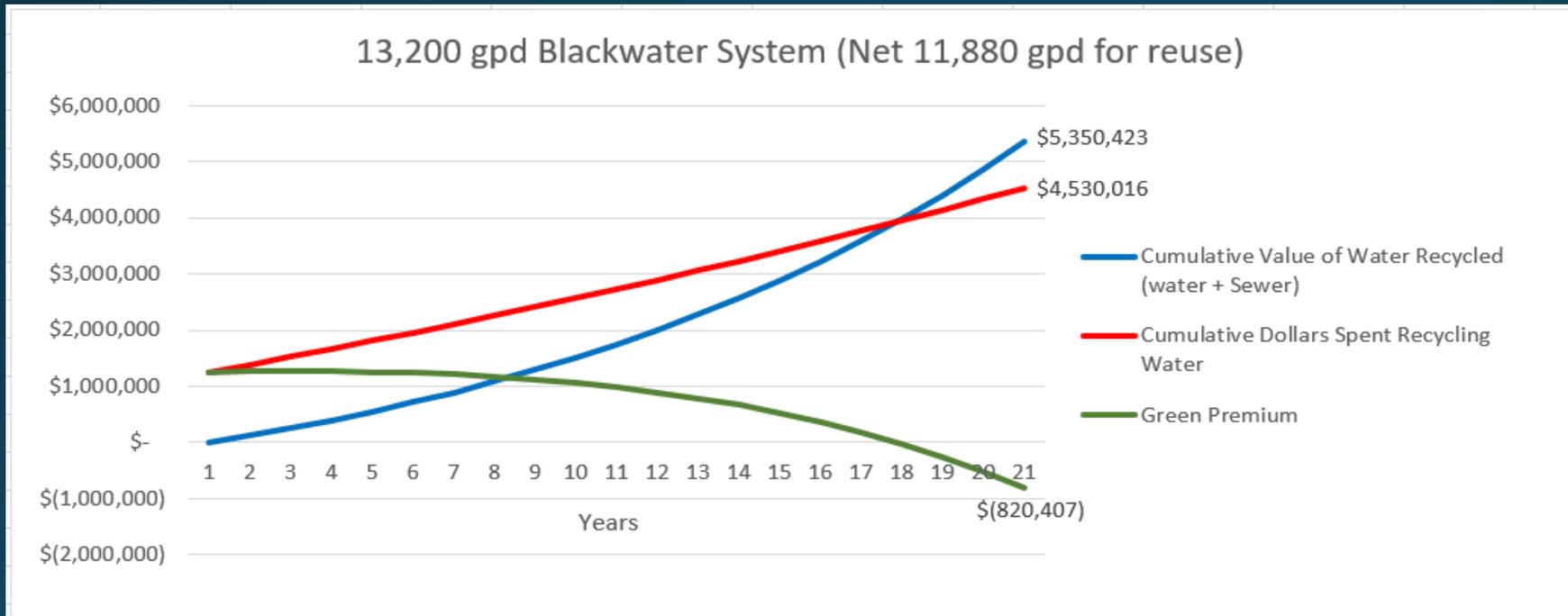
13,200 Gallons of Greywater Recycled Daily



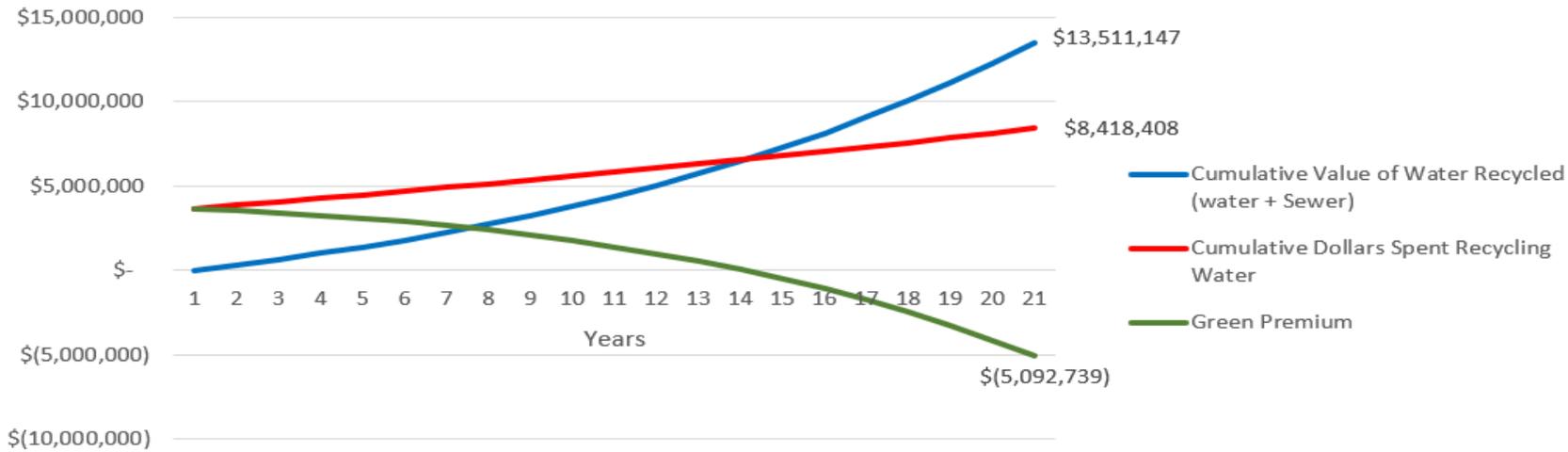
26,400 Gallons of Greywater Recycled Daily



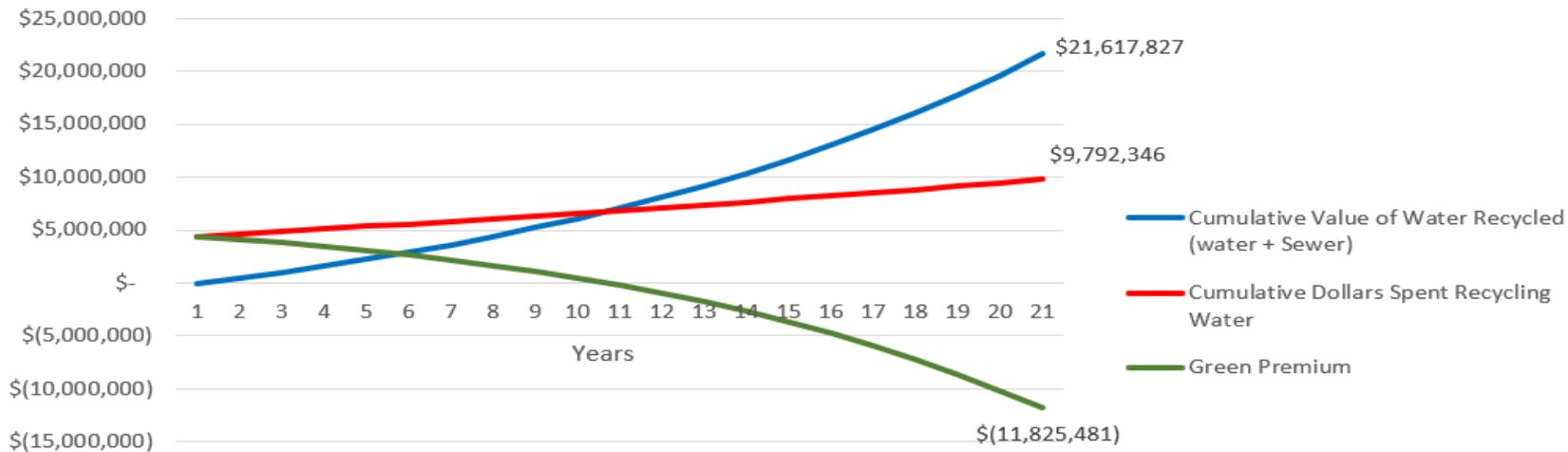
Blackwater Recycling Green Premium



40,000 gpd Blackwater System (Net 30,000 gpd reused)



64,000 gpd Blackwater System (Net 48,000 gpd reused)



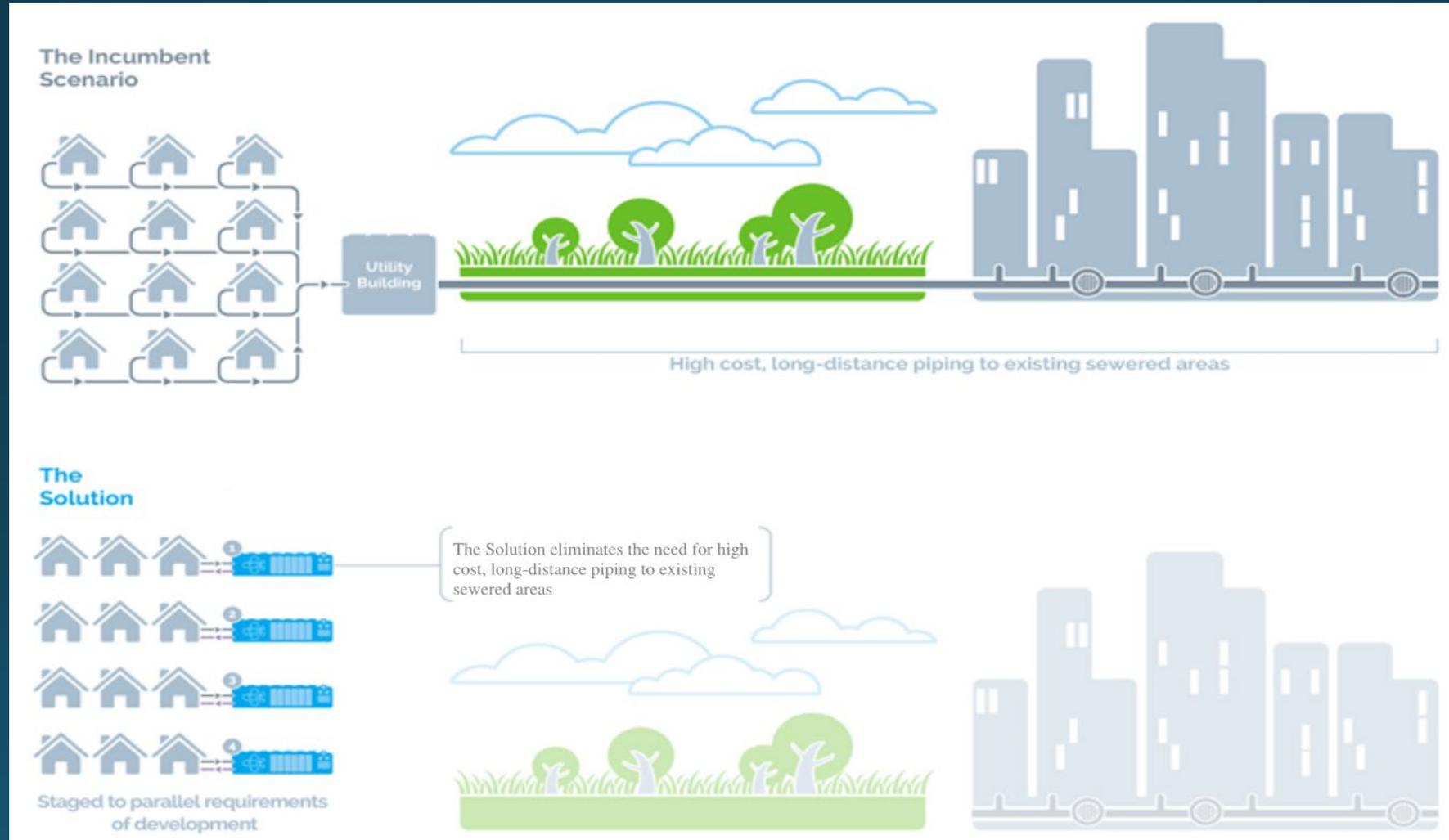
Greywater & Blackwater Recycling Takeaways

1. The greater the volume of greywater and/or blackwater being recycled, the sooner the **Green Premium** switches from positive to negative.
2. Many factors can impact the **Green Premium**. Not a one-size-fits-all equation.
 1. Tank Sizes & Cost of Construction
 2. Cost of Water Sample Analysis for Regulatory Compliance
 3. Cost of Consumables & Chemicals
 4. Is separated potable and non-potable water distribution piping already required?

Trends Affecting Decision-Making

- Drought
- Is there a Return on the Investment?
- Who will maintain the system while its operating?
- New Construction or Retrofit?
- Can the **Green Premium** calculation be improved by charging the tenants for the recycled water?
- Grant Funding Available?
- Mandate- yes or no?
- Location of Building or Development in relation to existing sewer system

Water Recycling Solutions for Remote Developments



How much water can be saved by recycling?

Rainwater	Low End	High End
Commercial	Building Type & Geographical Region Dependent	
Residential		

Greywater	Low End	High End
Commercial	17%	25%
Residential	20%	50%

Blackwater	Low End	High End
Commercial	60%	80%
Residential	18%	60%

New Technologies to reduce the Green Premium

- 1. District Scale Water Recycling Systems
- 2. Integrate multiple water sources into 1 recycling system
- 3. Integrate the ability to remotely operate, and remotely monitor a recycled water system.
- 4. Additional Surrogate Parameters or Critical Control Points for monitoring water quality in real time.
- 5. Mandates for water recycling take optional costs out of the Green Premium calculation.

Thank You!

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