COLUMBIA SPS
School of Professional Studies

IMPROVING THE SUSTAINABILITY OF DRINKING WATER DESALINATION IN CAPE MAY, NJ

May 7th 2025

FINAL BRIEFING AGENDA

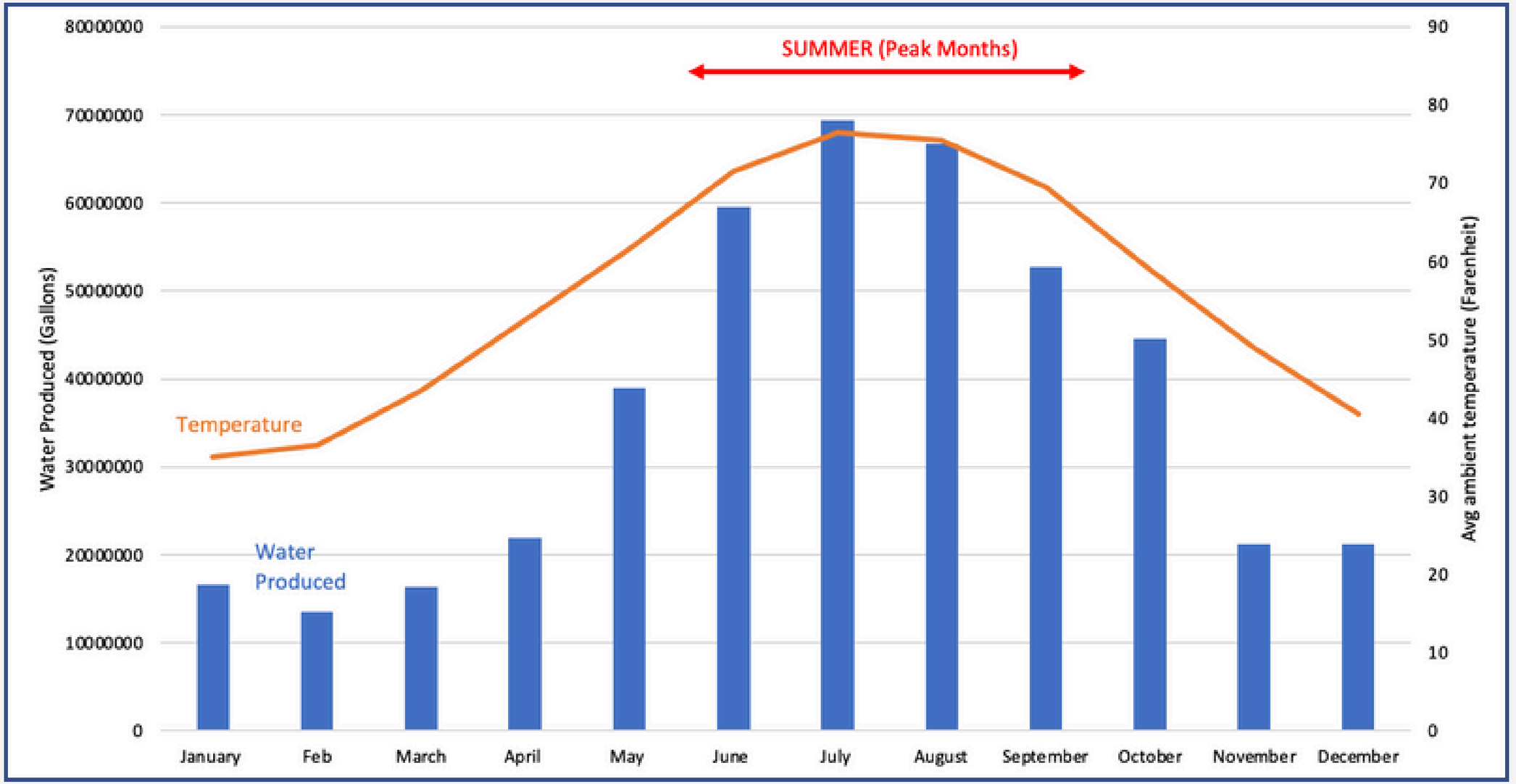
BACKGROUND

PROBLEM STATEMENT

STRATEGIC SOLUTIONS

NEXT STEPS

WATER DEMAND IN CAPE MAY



SOURCE: PRIMARY DATA FROM CAPE MAY CITY DESALINATION OPERATIONS TEAM

PROBLEM STATEMENT

CAPE MAY CITY'S ONLY SOURCE OF DRINKING WATER, AN AGING DESALINATION PLANT, IS STRUGGLING TO MEET PEAK DEMAND

STRATEGIC SOLUTIONS

- **IMPROVE OPERATIONAL EFFICIENCY**
- **MAXIMIZE DESALINATION YIELD**
- **BUILD A WATER DEMAND REDUCTION PLAN**
- **FINANCIAL ANALYSES**

4 KEY AREAS

CIRCULARITY

75% desalinated, 25% waste called “concentrate”

DESALINATION OPS

Efficient operations: Energy Recovery Device

DEMAND

Reduce water demand: Behavioral change through various policies

FINANCE

Economic viability for sustainable operations

CIRCULARITY

SOLUTION SUMMARY

Cape May generates 109M gallon of concentrate per year. The potential commercial value of its applications:

Salt extracted from concentrate

Minerals extracted from concentrate

Irrigate landscaping with concentrate

CIRCULARITY

SOLUTION: MONETIZE WASTE

	Salt	Minerals	Landscaping
VALUE	$165 PER TON (POST EVAPORATION)	HIGHLY VARIABLE	DEMAND OFFSET OF 1 MILLION GALLONS PER YEAR
FORM	EVAPORATED	OFTEN EVAPORATED	LIQUID
IMPLEMENTATION EASE	LOW	LOW	HIGH
POTENTIAL BUYERS	HAVEN Salt Company LLC; The SALT Depot	Albemarle®	CITY OF CAPE MAY NEW JERSEY

CIRCULARITY

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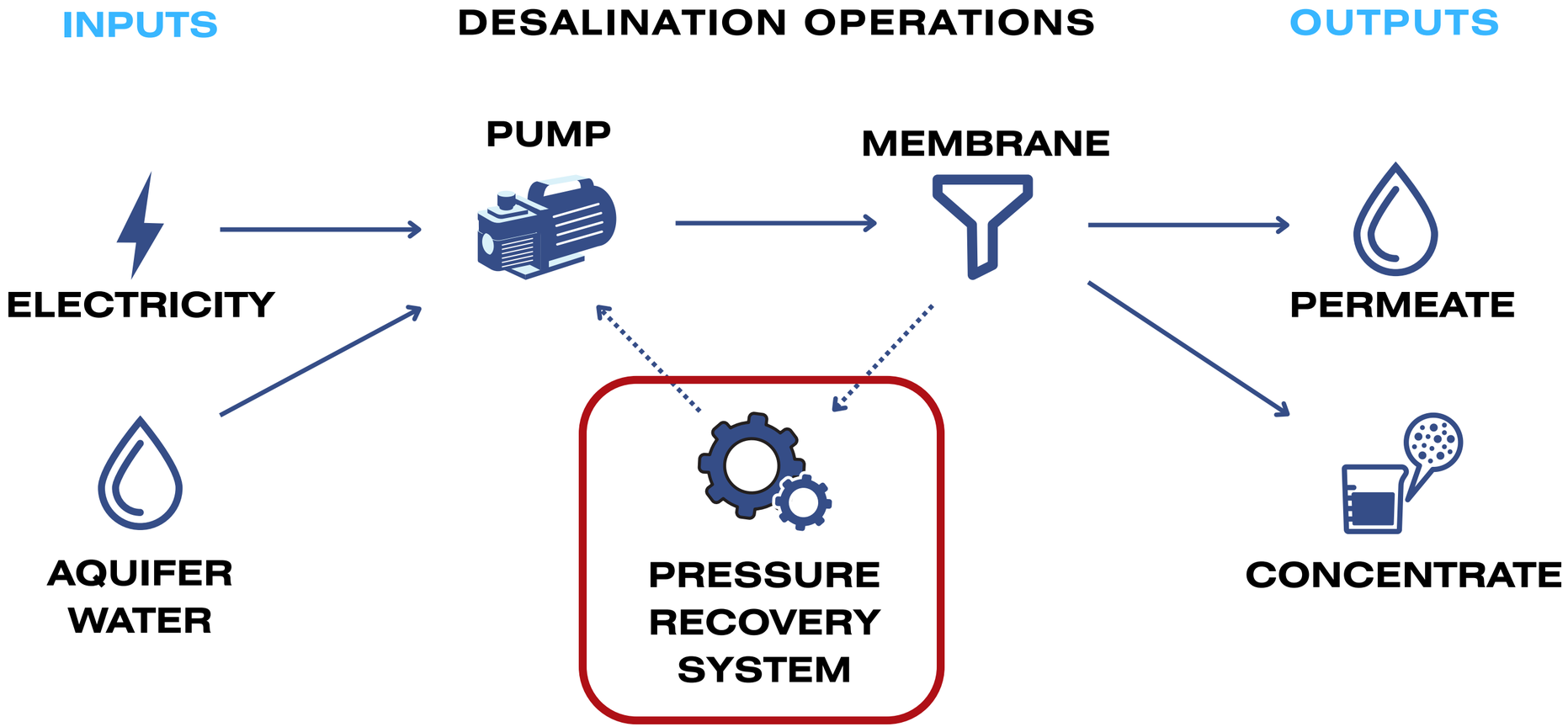
Best use case: Irrigating city land with concentrate

DESALINATION

PROBLEM SUMMARY



DESALINATION

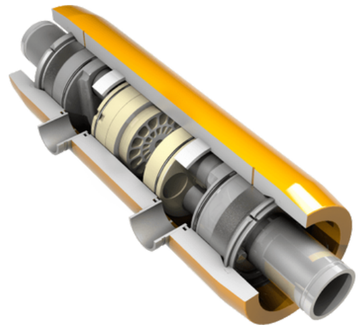
SOLUTION SUMMARY

Problem: Sustainability of desalination plant operations

Solution: Use **energy efficient** measures to increase plant lifespan

Main Findings:

Cape May can significantly improve its operational and energy efficiency by:



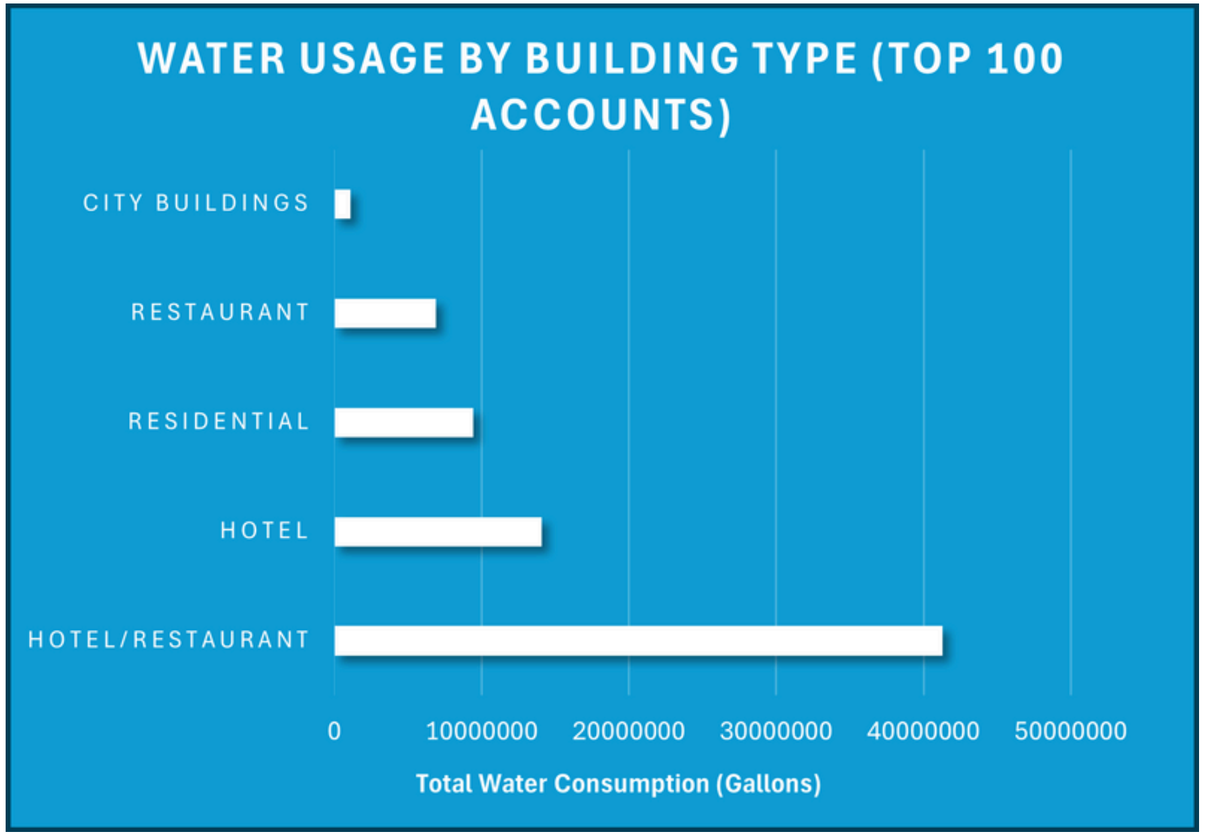
Installing an **energy recovery system in the new desalination facility. Cape May is now on track to install three turbochargers**

DEMAND

WATER CONSERVATION PROPOSAL

DEMAND

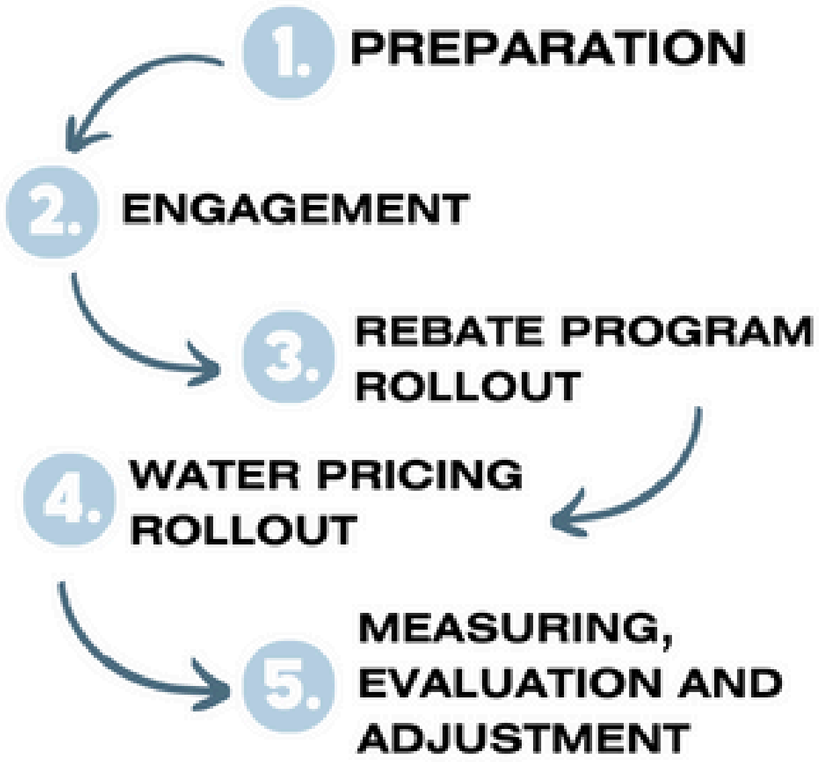
WATER USAGE ANALYSIS



Data Source: Cape May City Water & Sewer Department

DEMAND

PROPOSED IMPLEMENTATION TIMELINE



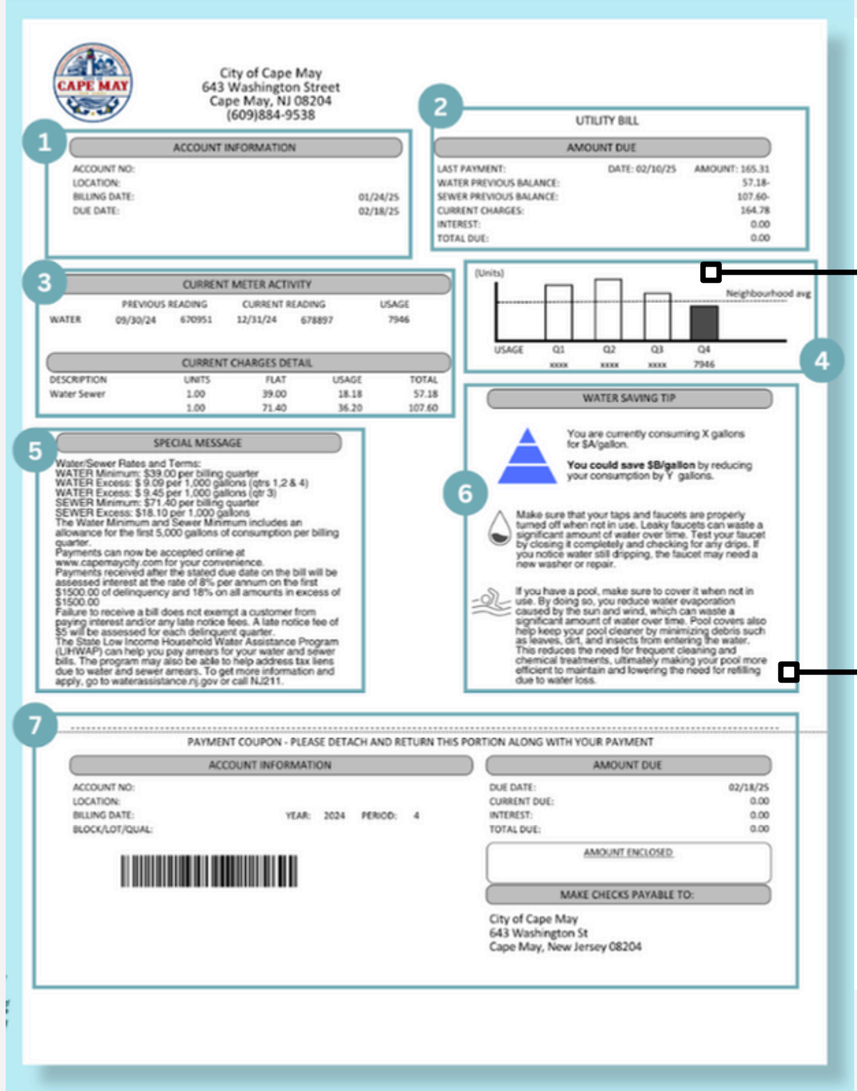
DEMAND

SOLUTION: COMMUNITY ENGAGEMENT

Elementary and Middle School Curriculum	Junior High and High School Curriculum - LCMR
1. Understanding water and the water cycle 2. Recognizing the importance of water and its critical uses ○ Suggested activity: journaling and logging daily water use 3. Addressing water scarcity and conservation strategies 4. Exploring the history of water in Cape May 5. Field trip to the Cape May desalination site (only accessing areas that are safe for the children)	1. In-depth analysis of water usage and critical applications 2. Water scarcity challenges and conservation strategies 3. Historical perspective on water management in Cape May 4. Field Trip to the Cape May desalination plant
Follow-up activity: - Designing posters for public awareness campaigns	Follow-up activities: - Selecting posters designed for public awareness campaign - Identifying optimal locations for public educational signage - Collaboration between school newspaper and Exit Zero, the local newspaper, on the source and operations of water supply in Cape May

DEMAND

SOLUTION: COMMUNITY ENGAGEMENT



City of Cape May
643 Washington Street
Cape May, NJ 08204
(609)884-9538

1 ACCOUNT INFORMATION

ACCOUNT NO:
LOCATION:
BILLING DATE: 01/24/25
DUE DATE: 02/18/25

2 UTILITY BILL

AMOUNT DUE

LAST PAYMENT: DATE: 02/10/25 AMOUNT: 165.31
WATER PREVIOUS BALANCE: 57.18-
SEWER PREVIOUS BALANCE: 107.60-
CURRENT CHARGES: 164.78
INTEREST: 0.00
TOTAL DUE: 0.00

3 CURRENT METER ACTIVITY

	PREVIOUS READING	CURRENT READING	USAGE
WATER	09/30/24 670951	12/31/24 678897	7946

CURRENT CHARGES DETAIL

DESCRIPTION	UNITS	FLAT	USAGE	TOTAL
Water Sewer	1.00	39.00	18.18	57.18
	1.00	71.40	36.20	107.60

4

5 SPECIAL MESSAGE

Water/Sewer Rates and Terms:
WATER Minimum: $39.00 per billing quarter
WATER Excess: $ 9.09 per 1,000 gallons (qtrs 1,2 & 4)
WATER Excess: $ 9.45 per 1,000 gallons (qtr 3)
SEWER Minimum: $71.40 per billing quarter
SEWER Excess: $18.10 per 1,000 gallons
The Water Minimum and Sewer Minimum includes an allowance for the first 5,000 gallons of consumption per billing quarter.
Payments can now be accepted online at www.capemaycity.com for your convenience.
Payments received after the stated due date on the bill will be assessed interest at the rate of 8% per annum on the first $1500.00 of delinquency and 18% on all amounts in excess of $1500.00
Failure to receive a bill does not exempt a customer from paying interest and/or any late notice fees. A late notice fee of $5 will be assessed for each delinquent quarter.
The State Low Income Household Water Assistance Program (LIHWAP) can help you pay arrears for your water and sewer bills. The program may also be able to help address tax liens due to water and sewer arrears. To get more information and apply, go to waterassistance.nj.gov or call NJ211.

6 WATER SAVING TIP

You are currently consuming X gallons for $A/gallon.

You could save $B/gallon by reducing your consumption by Y gallons.

Make sure that your taps and faucets are properly turned off when not in use. Leaky faucets can waste a significant amount of water over time. Test your faucet by closing it completely and checking for any drips. If you notice water still dripping, the faucet may need a new washer or repair.

If you have a pool, make sure to cover it when not in use. By doing so, you reduce water evaporation caused by the sun and wind, which can waste a significant amount of water over time. Pool covers also help keep your pool cleaner by minimizing debris such as leaves, dirt, and insects from entering the water. This reduces the need for frequent cleaning and chemical treatments, ultimately making your pool more efficient to maintain and lowering the need for refilling due to water loss.

7 PAYMENT COUPON - PLEASE DETACH AND RETURN THIS PORTION ALONG WITH YOUR PAYMENT

ACCOUNT INFORMATION

ACCOUNT NO:
LOCATION:
BILLING DATE: YEAR: 2024 PERIOD: 4
BLOCK/LOT/QUAL:

AMOUNT DUE

DUE DATE: 02/18/25
CURRENT DUE: 0.00
INTEREST: 0.00
TOTAL DUE: 0.00

AMOUNT ENCLOSED

MAKE CHECKS PAYABLE TO:

City of Cape May
643 Washington St
Cape May, New Jersey 08204

4 Consumption Graph

This is a visual representation of water usage over different time periods. It compares the customer's usage with the neighborhood average, giving insights into how the customer's water consumption measures up against similar households in the area.

The neighbour average is derived based on the average usage of similiar housing types within a block or street for landed premises.

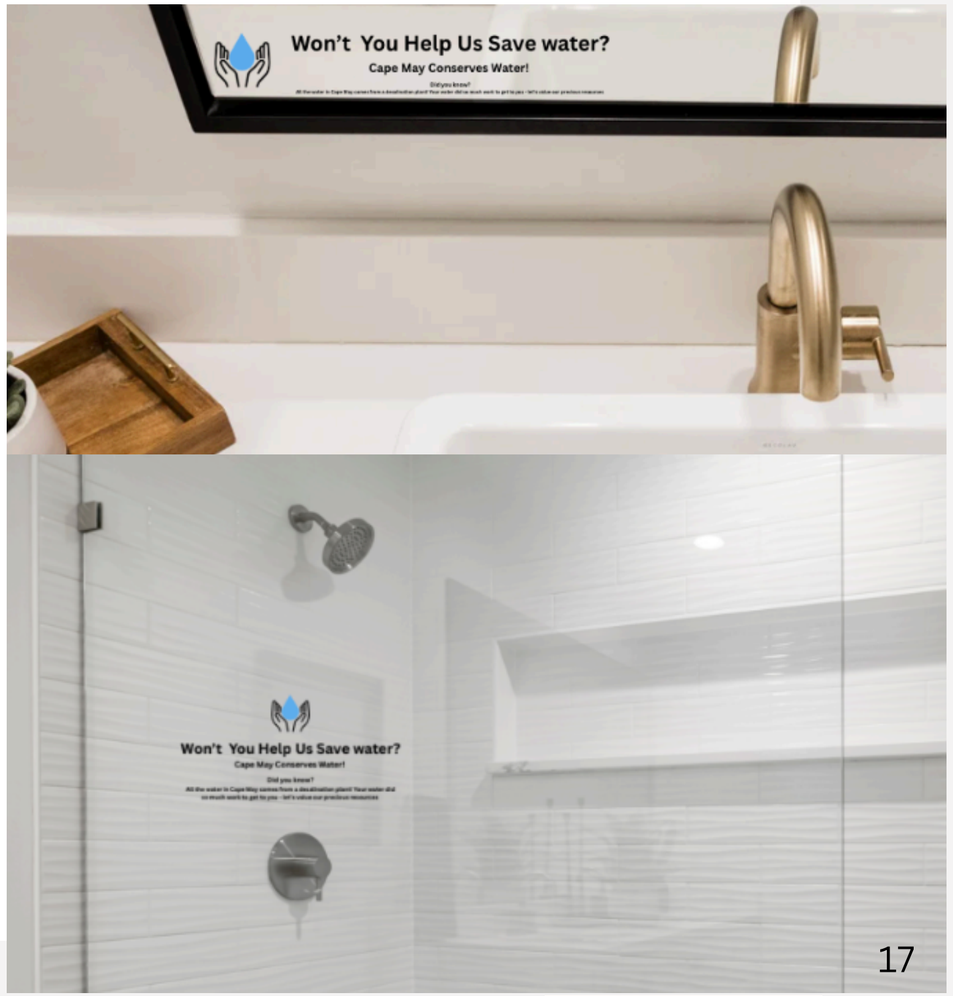
6 Water Saving Tips

Practical advice for water conservation is provided here. It offers suggestions on how customers can reduce water usage, such as checking for leaks, adjusting faucets, or covering pools to prevent unnecessary water loss.

DEMAND

SOLUTION: BUSINESS ENGAGEMENT

Category	Measure	Impact
Guest Engagement	Place mirror-adjacent signage on water use	Increases guest awareness and action (Stanford SPARQ, n.d.)
Guest Engagement	Offer opt-out options for daily linen/towel changes	Reduces laundry-related water use (Han & Hyun, 2018)
Bathroom Fixtures	Install low-flow showerheads and faucet aerators	Cuts water use by 20-30% (American Hotel & Lodging Association, n.d.)
Toilet Systems	Use dual-flush or low-flow toilets	Reduces flush volume significantly (EPA, 2025; (Northern Ireland Water, 2024))
Kitchen and Laundry Operations	Upgrade to ENERGY STAR-rated dishwashers and washers	Lowers water and energy consumption (EPA, 2017)
Irrigation Systems	Install smart irrigation controllers and drought-tolerant landscaping	Minimizes outdoor water usage (Bwambale et al., 2022)
Leak Detection	Implement routine leak audits and monitoring systems	Prevents unintentional waste (Snyder et al., 2024)



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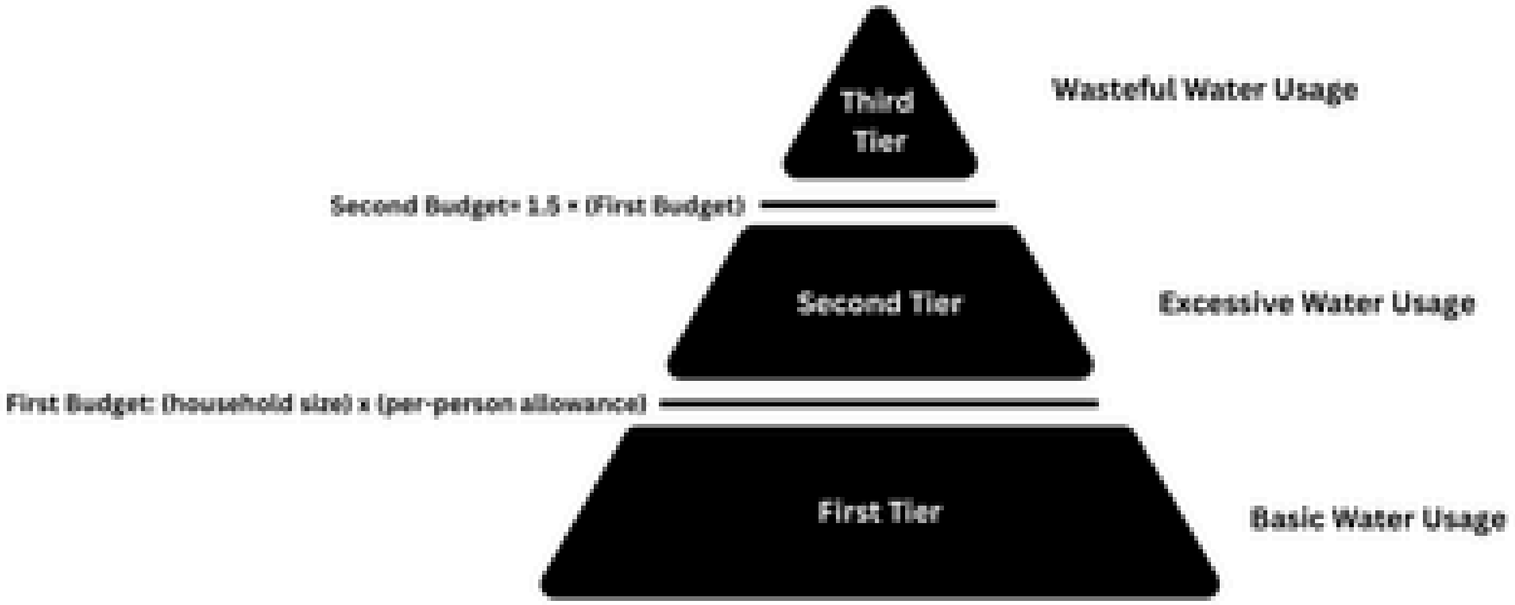
RESIDENTIAL WATER PRICING MODEL



DEMAND

REBATE PROGRAM CASE STUDIES

Case Study	Initiatives	Water Savings	Cost Savings
Hilton Palacio del Rio Hotel	Retrofits for toilets, faucets, showerheads and water-cooled ice machines	26 million gallons	$160,000 in water, sewer and energy costs per year
Westin Riverwalk Hotel in San Antonio	High-efficiency toilets and washing machine upgrades	2.2 million gallons of water per year	$20,000 in water, sewer and energy costs

DEMAND

COST BENEFIT ANALYSIS

TOTAL UPFRONT COST
(ONE TIME $)

~$150,000

LIFETIME CONSERVATION
(GALLONS/LIFETIME)

46,000,000+

CONSERVATION COST
($/GALLON)

$0.003

COST SAVINGS TO HOTELS
($/HOTEL)

$15,000-50,000

COST-EFFECTIVE SOLUTION TO PROMOTE WATER CONSERVATION AND SUPPORT TOURISM INDUSTRY

DESALINATION

FINANCIAL PAYBACK ANALYSIS

TOTAL UPFRONT COST

$195,000

ANNUAL COST SAVINGS

$15,000-30,000

LIFETIME COST SAVINGS

$450,000

PAYBACK PERIOD

11 YEARS

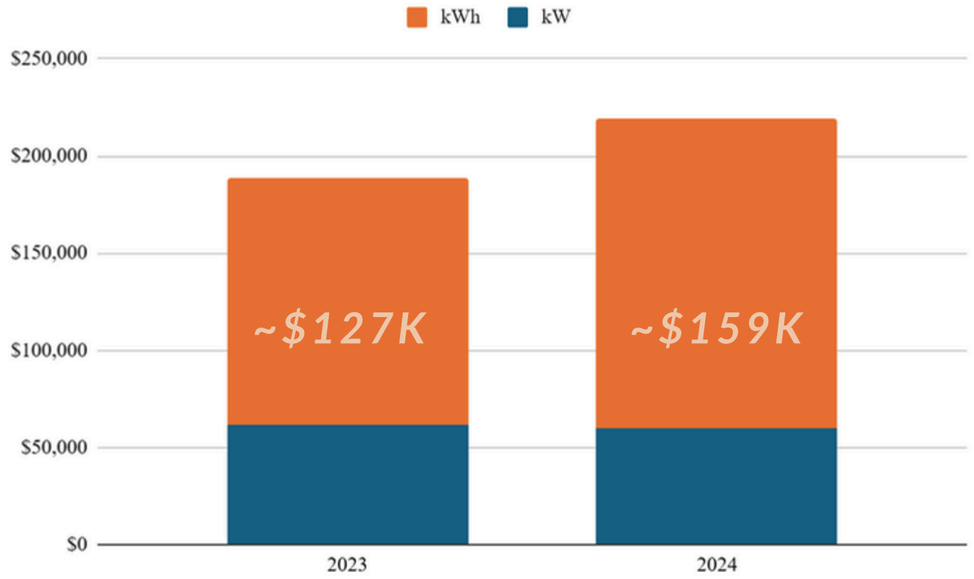
ERDS CAN REDUCE ELECTRICITY NEEDS, LOWER UTILITY BILLS AND GENERATE A NET PROFIT FOR CAPE MAY

FINANCE

PROBLEM SUMMARY

LEVERAGE UTILITY BILL ANALYSIS TO QUANTIFY POTENTIAL COST SAVINGS

Utility bill expenses for desalination plant



kW = charges based on capacity (unable to offset)
kWh = charges based on consumption (can be offset)

Utility bill summary

- Data based on provided utility bills
- kWh is the cost that can be saved
- ~67% in 2023 and ~73% in 2024
- Solar can help offset the $/kWh cost of utility bill

ENERGY USAGE DRIVES HIGH OPERATING COSTS FOR PLANT

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CAPACITY & COST ASSESSMENT

PROPOSED SOLAR CAPACITY EXPANSION FOR DESALINATION OPERATIONS

Illustrative mapping of 133kW solar system

Proposal summary

- Propose to add significant capacity to existing solar array using Helioscope software
- Projected annual savings of ~$40,000 to reduce operating costs
- Payback period of 5 to 6 years over the 30 year asset life

ONSITE SOLAR COULD REDUCE ANNUAL COSTS BY $40K

FINANCE

SOLUTION SUMMARY

Problem: Improve economic viability of desalination plant operations

Solution: Install **behind-the-meter** solar to reduce utility bills

Main Findings:

Cape May can significantly reduce operating costs by generating onsite electricity to reduce utility bill expenses:

Install an onsite **photovoltaic solar system on the new desalination facility**

NEXT STEPS

EASY

COMPLEX

IRRIGATE WITH CONCENTRATE

ENSURE PLANS FOR NEW PLANT
MEET BEST PRACTICES

INITIATE ONSITE SOLAR DEVELOPMENT PROCESS

DEVELOP REBATE INCENTIVE PROGRAM

IMPLEMENT NEW WATER PRICING SYSTEM

COLUMBIA SPS
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APPENDIX

DESALINATION

FINANCIAL PAYBACK ANALYSIS

METRIC	CALCULATION APPROACH	MODELED ESTIMATE
Upfront Cost	**Number of devices (#)** multiplied by **device cost ($)**	**$195,000**
Annual Cost Savings	**Reduction in electricity usage (kWh)** multiplied by **electricity cost ($/kWh)**	**$15-30,000**
Lifetime Cost Savings	**Cumulative cost savings over 30 years ($)** minus **upfront cost ($)**	**$450,000**
Payback period	**Upfront cost ($)** divided by **annual cost savings ($/y)**	**11 years**

DESALINATION

FINANCIAL PAYBACK ANALYSIS

PAYBACK PERIOD (YEARS)

Reduction in energy needs for water pumps due to ERD installation (%)

Energy for water pumps / total plant energy usage (%)	10%	15%	20%	25%	30%
55%	22.4	16.0	12.4	10.2	8.6
60%	20.9	14.8	11.5	9.4	8.0
65%	19.5	13.8	10.7	8.7	7.4
70%	18.4	13.0	10.0	8.2	6.9

LIFETIME COST SAVINGS ($)

10%	15%	20%	25%	30%
$94	$238	$383	$527	$672
$120	$278	$435	$593	$751
$147	$317	$488	$659	$830
$173	$357	$541	$724	$908

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COST BENEFIT ANALYSIS: UNIT VIEW

SHOWERHEAD (10 YR USEFUL LIFE)

Rebate		Customer Perspective	
($)	*(% of cost)*	Payback period (yrs)	Lifetime cost savings ($)
$0	*0%*	1.3	$198
$5	*17%*	1.1	$203
$10	*33%*	0.9	$208
$15	*50%*	0.7	$213
$20	*67%*	0.4	$218
$25	*83%*	0.2	$223
$30	*100%*	0.0	$228

TOILETS (30 YR USEFUL LIFE)

Rebate		Customer Perspective	
($)	*(% of cost)*	Payback period (yrs)	Lifetime cost savings ($)
$80	*40%*	22.0	$39
$100	*50%*	22.0	$59
$120	*60%*	17.6	$79
$140	*70%*	13.2	$99
$160	*80%*	8.8	$119
$180	*90%*	4.4	$139
$200	*100%*	0.0	$159

WATER-EFFICIENT FIXTURES REDUCE WATER BILLS & PAYBACK PERIODS ON A UNIT BASIS ARE POSITIVE

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COST BENEFIT ANALYSIS: HOTEL VIEW

ILLUSTRATIVE IMPACT OF REBATE PROGRAM ON TARGET HOTELS

Hotel	Annual water usage, 2024 (g)	Est. annual water savings (g)	Reduction (%)	Lifetime cost savings ($)
Congress Hall	10,248,000	374,344	3.7%	$33,590
Grand Hotel	8,821,000	581,080	6.6%	$52,009
The Beach Shack	4,640,630	272,728	5.9%	$24,536
La Mer Beachfront Resort	3,937,530	570,568	14.5%	$51,072
Marquis de Lafayette	3,620,432	290,248	8.0%	$26,097
Sandpiper Beach Club	2,752,000	181,624	6.6%	$16,419
Montreal Beach Resort	2,594,819	248,200	9.6%	$22,351
Ocean Club Hotel	2,408,000	318,280	13.2%	$28,594
The Inn of Cape May	1,914,554	181,624	9.5%	$16,419
ICONA Cape May	1,773,040	199,144	11.2%	$17,980
Total	**42,710,005**	**3,217,840**	**7.5%**	**$289,066**

AVG. REDUCTION IN USAGE OF 7.5%

AVG. LIFETIME COST SAVINGS OF $19K

DEMAND

COST BENEFIT ANALYSIS: CITY VIEW

ILLUSTRATIVE IMPACT OF REBATE PROGRAM ON CAPE MAY CITY

Program Scale		Rebate		Total Costs to Cape May ($)			Impact Analysis	
	(#)	($)	(%)	Program administration	Rebate payments	Total costs	Lifetime water savings (g)	Cost per water saved ($/g)
Showerhead	910	$15	*50%*	$5,000	$13,650	$18,650	26,572,000	$0.001
Toilet	960	$140	*70%*	$5,000	$134,400	$139,400	19,622,400	$0.007
Total				**$10,000**	**$148,050**	**$158,050**	**46,194,400**	**$0.003**

COST-EFFECTIVE SOLUTION TO PROMOTE WATER CONSERVATION AND SUPPORT TOURISM INDUSTRY