

PLANT UPGRADES TO UV DISINFECTION TO INCREASE ENERGY EFFICIENCY

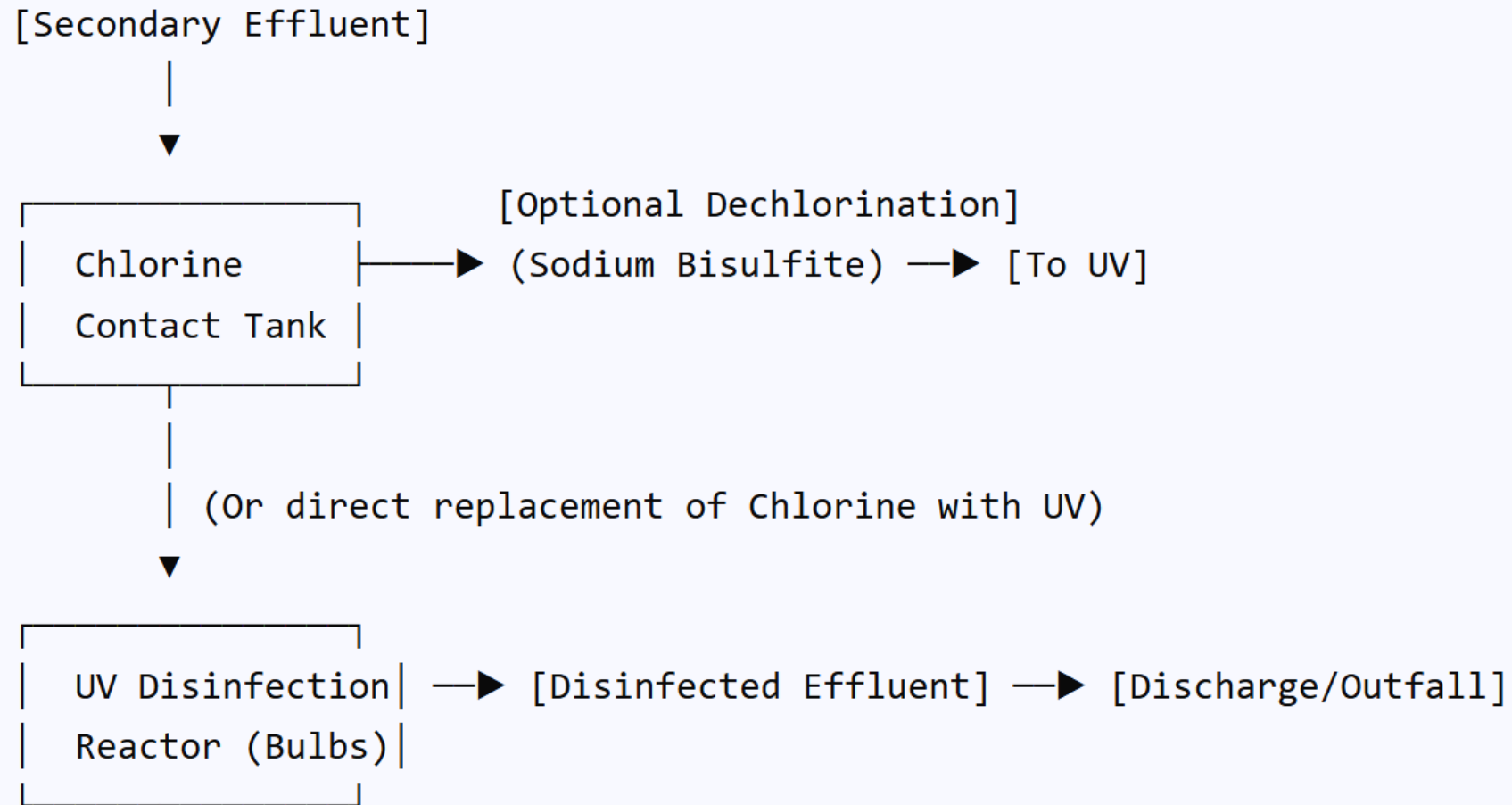
MARY-FRANCES KLIMEK

SUPERINTENDENT

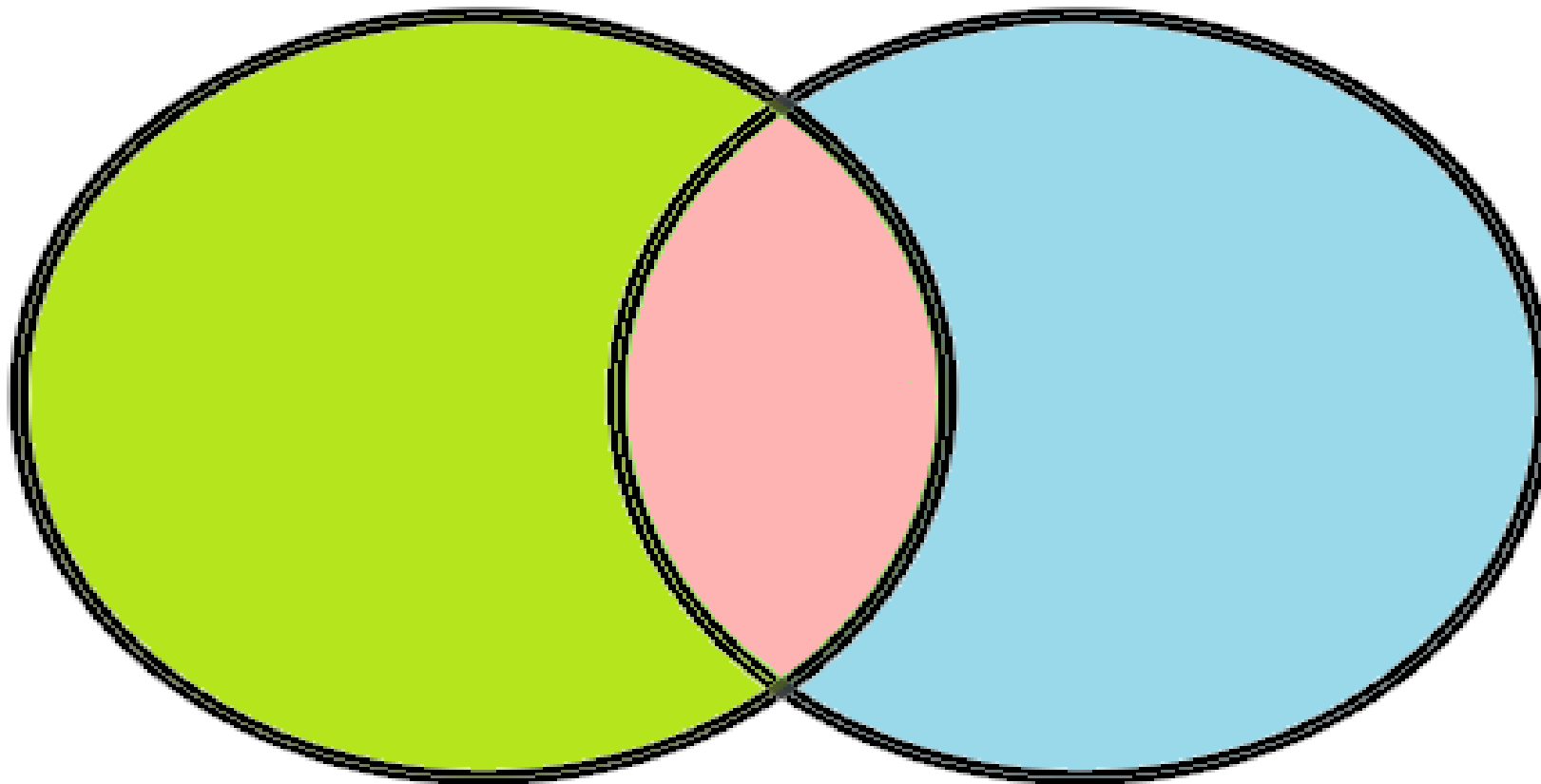
RACINE WASTEWATER UTILITY



2002 – THE DECISION TO SHIFT



IT WAS ALL ABOUT SAFETY



2020 Racine RWU Facilities Plan

Revised Final

Project number: 60554970

June 2022



RACINE ON THE LAKE

City of Racine, WISCONSIN

Racine Wastewater Utility





Operations Control Room

Preliminary Treatment Bldg

Biogas Sphere

Flow Equalization Basins

Generator Bldg

Solids Handling Bldg

Lab

Primary Clarifiers

Anaerobic Digesters

Aeration Tanks

Plant Outfall

Ultraviolet Disinfection

Vector Dump Station

Final Clarifiers

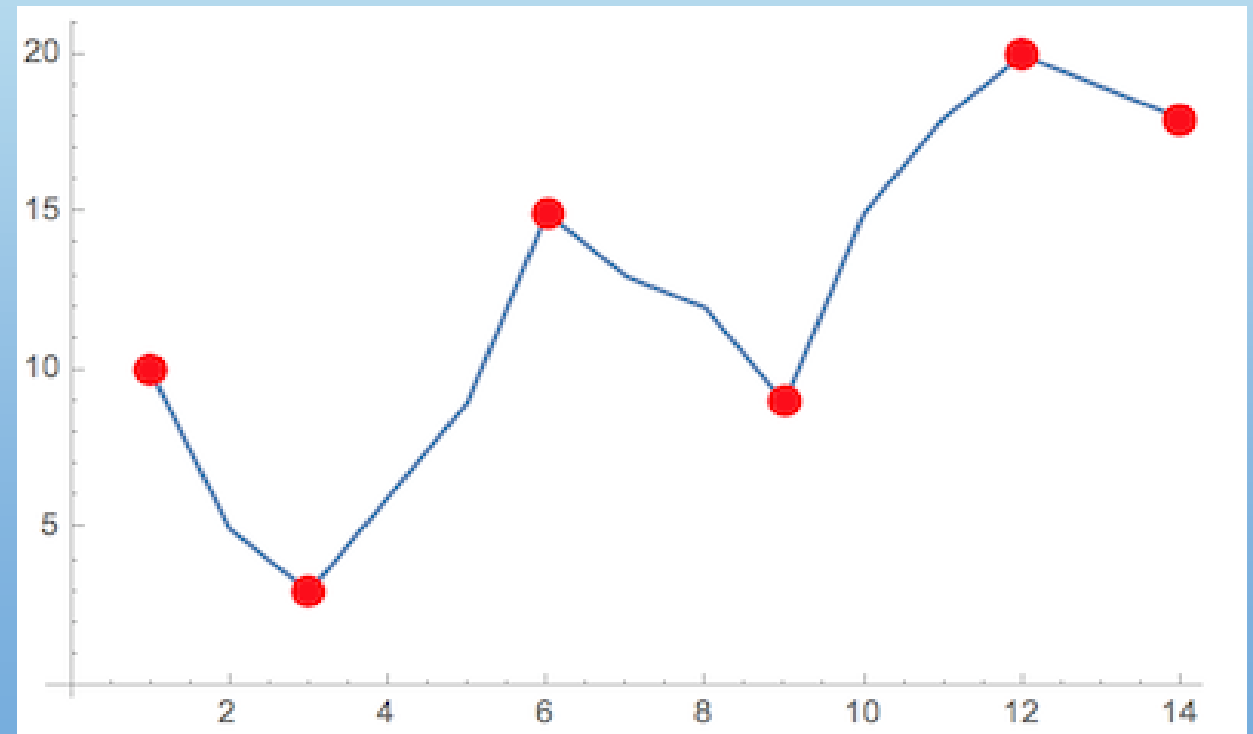
BACKGROUND INFORMATION

UV PRIOR TO UPGRADE

- TROJAN UV 4000 PLUS
- INSTALLED 2002
- DESIGN DOSE: 24 MJ/CM²
- REDUNDANT SYSTEMS

UTILITY CONSIDERATIONS

FLOW VARIATION



UTILITY CONSIDERATIONS

REPLACEMENT OF AGING INFRASTRUCTURE
& EQUIPMENT
ENERGY EFFICIENCY AND PROCESS
OPTIMIZATION



PERMIT CHANGES

Permit Requirements	Previous Permit	Current Permit
Year Round Disinfection Based on a Monthly Geometric Mean	Fecal Coliform 400 CFU/ 100 ml	E.Coli 126 CFU/ 100 (May-September) Fecal Coliform 400 CFU/ 100 ml (October – April)

BACKGROUND INFORMATION

EFFLUENT FLOWS

- FIVE YEAR AVERAGE: 22.97 MGD
- PEAK HOURLY : 108 MGD
- MINIMUM: 5 MGD

CONSIDERATIONS

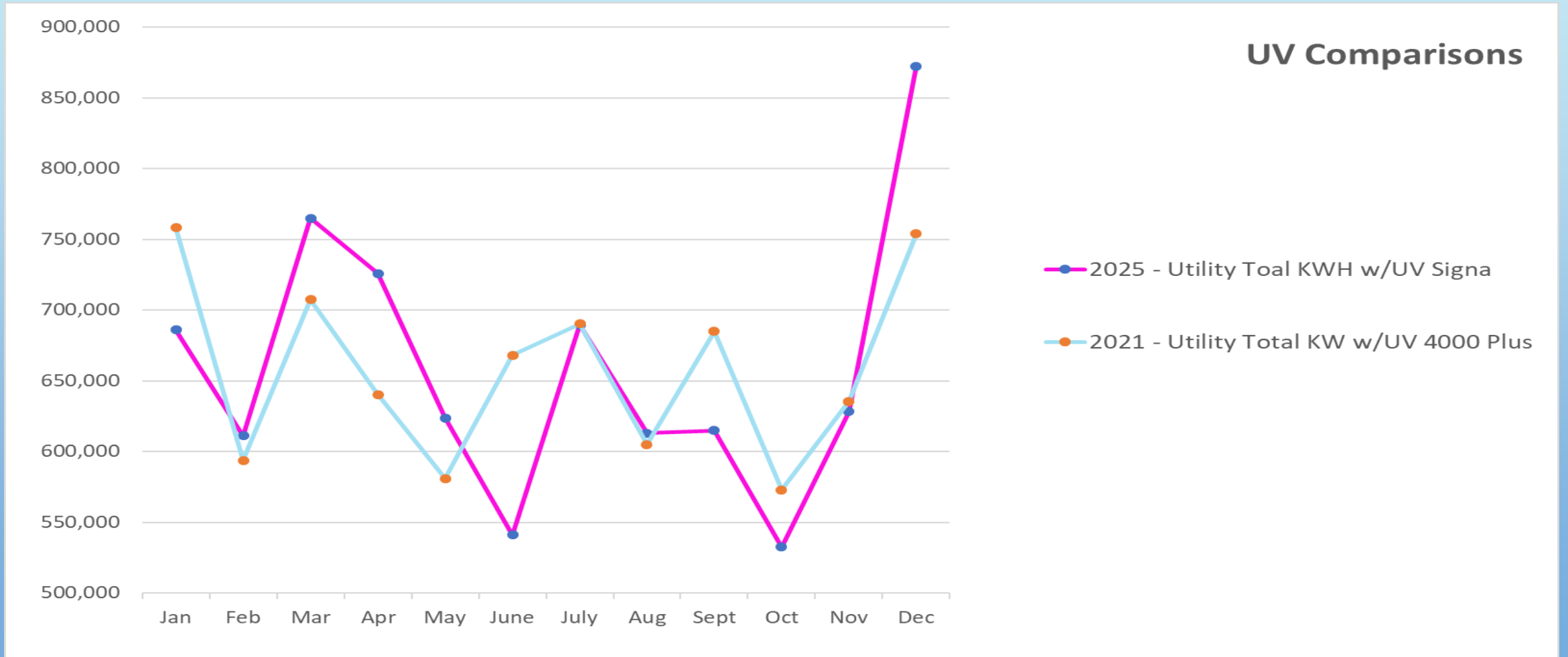
Design Parameter:	
Peak Hour Flow Rate (MGD)	108.0
Maximum Month Average Flow Rate (MGD)	41.30
Annual Average Flow Rate (MGD)	23.90
Design UV Transmittance (%)	68.0
Average UV Transmittance (%)	74.0
Total Suspended Solids (mg/L)	
Average	6.0
Maximum	30.0
New Permit Limit, shall not exceed:	
E. coli Permit Limit, based on monthly geometric mean	126 CFU/100 mL
E. coli Permit Limit, weekly average	399 CFU/100 mL

UV SYSTEM COMPARISON

UV Disinfection System	Trojan UV4000 Plus (Existing)	Trojan UV Signa (New)
No. of Channels	2	4
Lamps	Medium Pressure	Low Pressure High Output Amalgam
Configuration	Horizontal	Diagonal
Number of Lamps	320	384
Output in W	2800	1000
Actual Power Usage (kW)	1,410,000	469,624

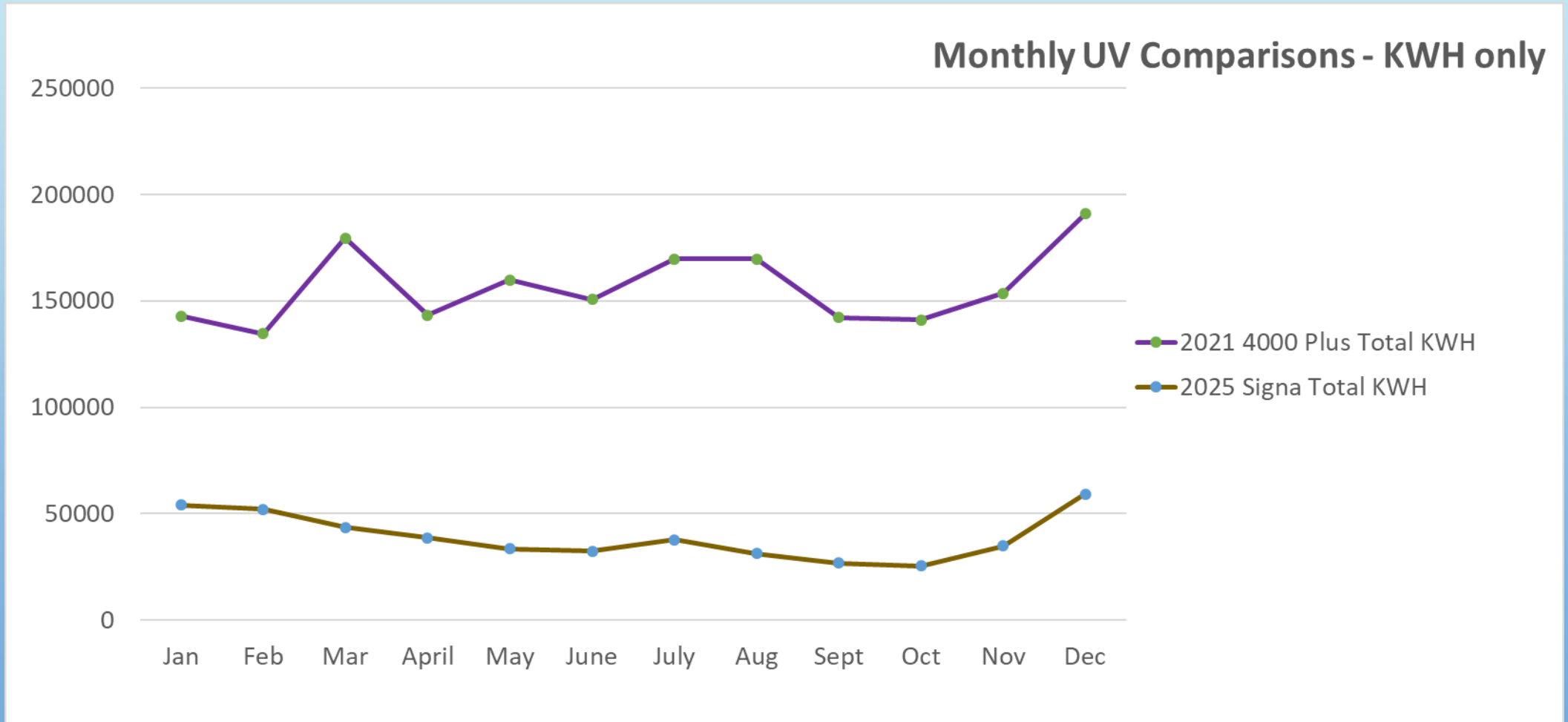
ENERGY COMPARISON

REDUCTION IN OVERALL UTILITY ENERGY USE



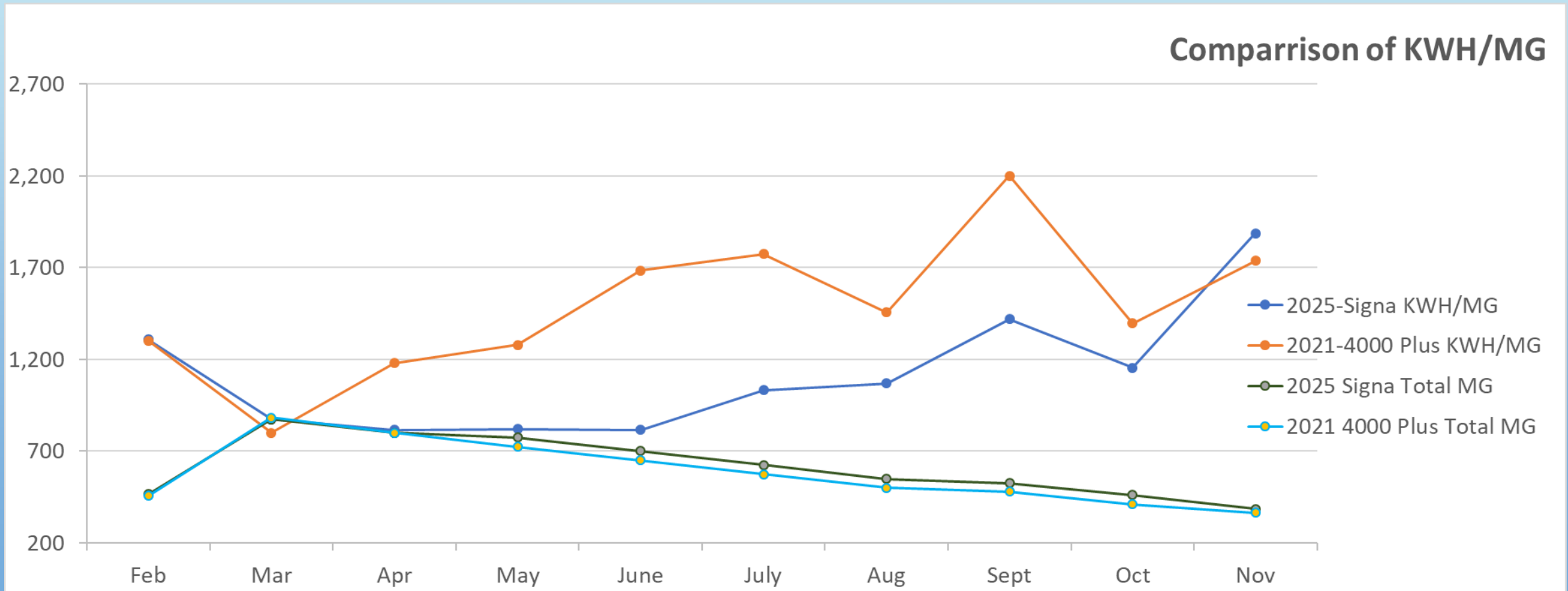
ENERGY COMPARISON

REDUCTION IN UV ENERGY USE



ENERGY COMPARISON

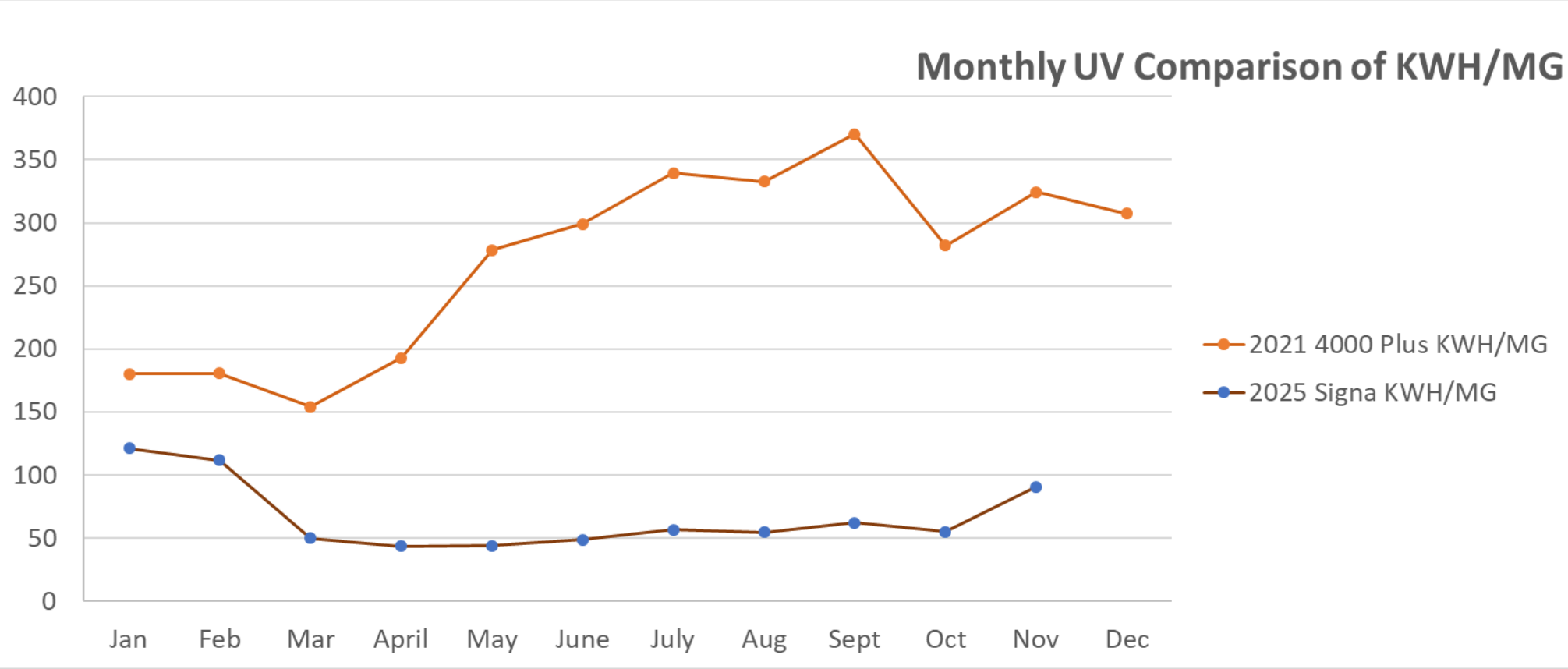
REDUCTION IN OVERALL UTILITY ENERGY USE TAKING EFFLUENT FLOW INTO ACCOUNT



ENERGY COMPARISON

REDUCTION IN UV ENERGY USE

TAKING EFFLUENT FLOW INTO ACCOUNT



ENERGY SAVINGS

Power Calculations / Cost – kW, \$	
New Trojan UVSigna 2-Row System	
Average Power Consumption (kW)	71.1
Total Power Consumption (kW)	408.8
Percentage of Time at Average Flow	95%
Percentage of Time at Peak Flow	5%
Weighted Power Consumption (kW)	87.9
Number of Operational Days per Year	365
Total Power Draw per Year (kWh)	770,403
Existing Trojan UV4000 System	
Average Power Consumption (kW)	196.2
Total Power Consumption (kW)	897.0
Percentage of Time at Average Flow	95%
Percentage of Time at Peak Flow	5%
Weighted Power Consumption (kW)	231.2
Number of Operational Days per Year	365
Total Power Draw per Year (kWh)	2,025,746
Energy Savings per Year (kWh)	1,255,342
Using \$0.098/kWh saved – Current Calculated Savings	\$123,023.53
Focus on Energy Incentive	\$77,097.35

ENERGY SAVINGS

PROJECTED 55%

ACTUAL 67% - BASED ON ONE DATA SET

QUESTIONS?

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