

Columbia River WTP Capacity and Maintenance Upgrades

Nathan Kutil, May 9, 2025



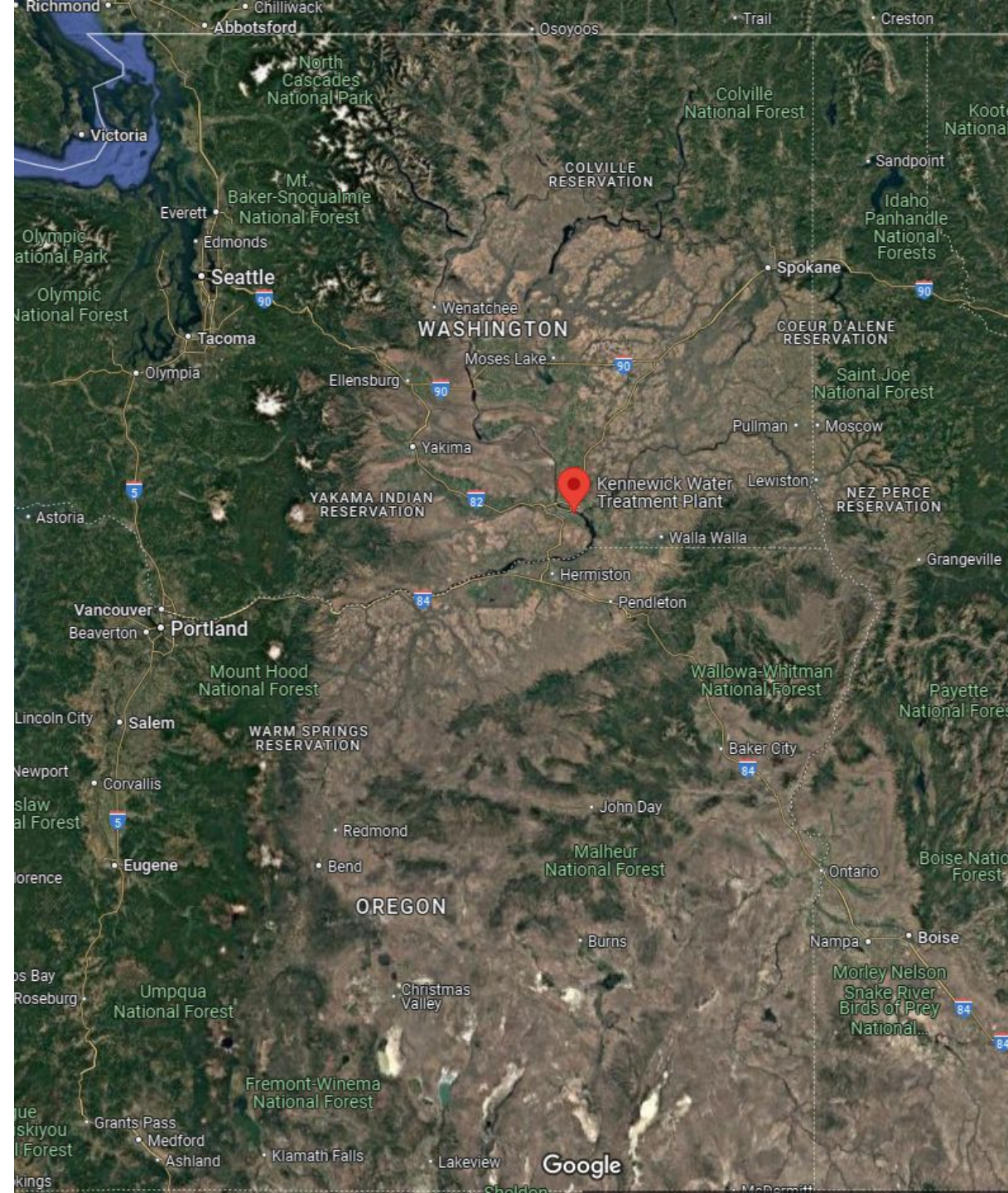


Nathan Kutil

Nathan is the West Region Drinking Water Treatment Business Class Leader at HDR. He lives in Missoula, Montana with his wife and two daughters. Nathan works mainly on WTP design projects and focuses on listening to the needs and ideas of those he is working for.

City of Kennewick

- 85,000 customers
- One of the Tri-Cities
- Three water supplies:
 - Columbia WTP – surface water supply from the Columbia River
 - Ranney Collectors 4 and 5 – groundwater under the influence of surface water (Columbia River)
 - ASR Well



Raw Water Quality – Columbia River

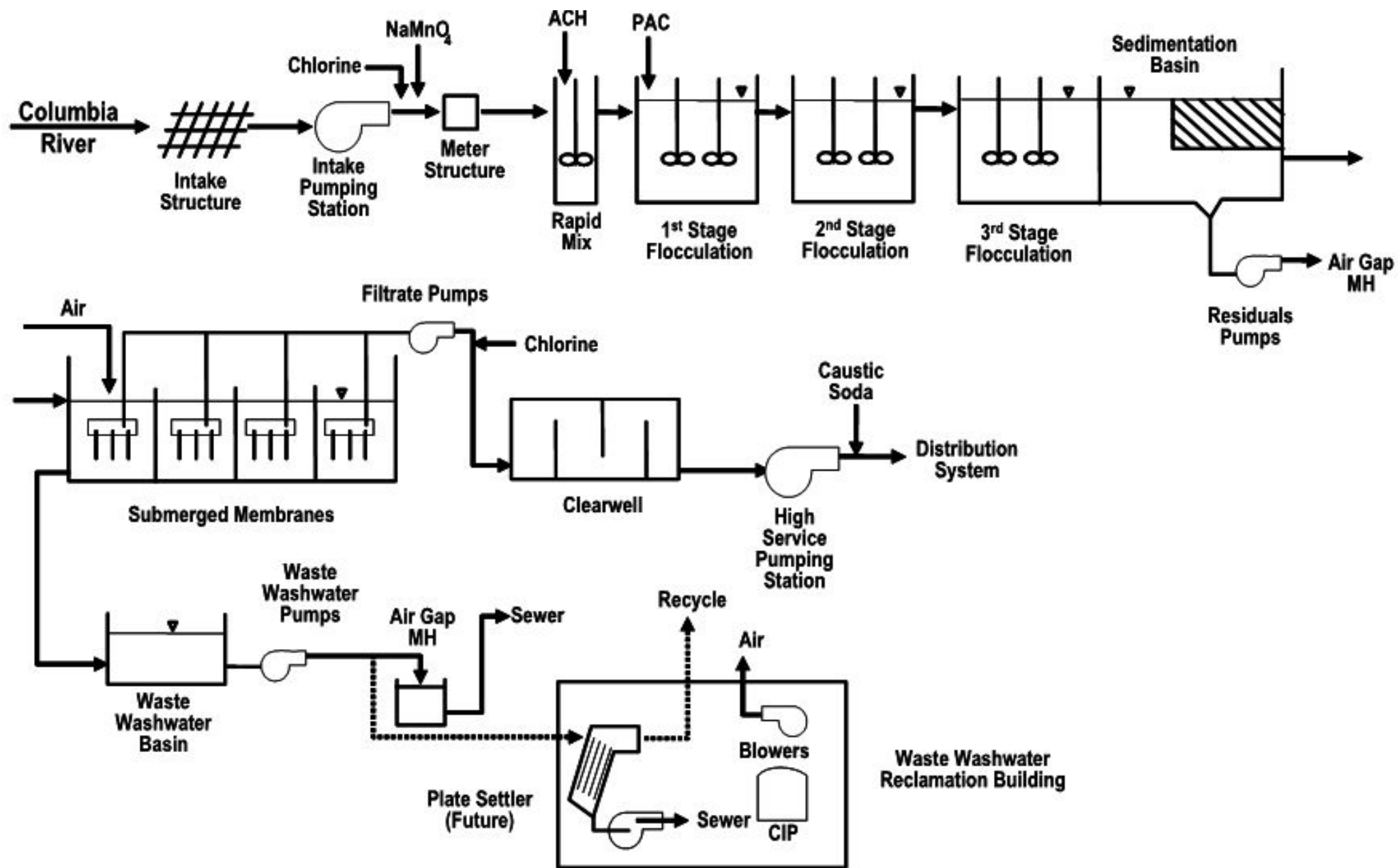


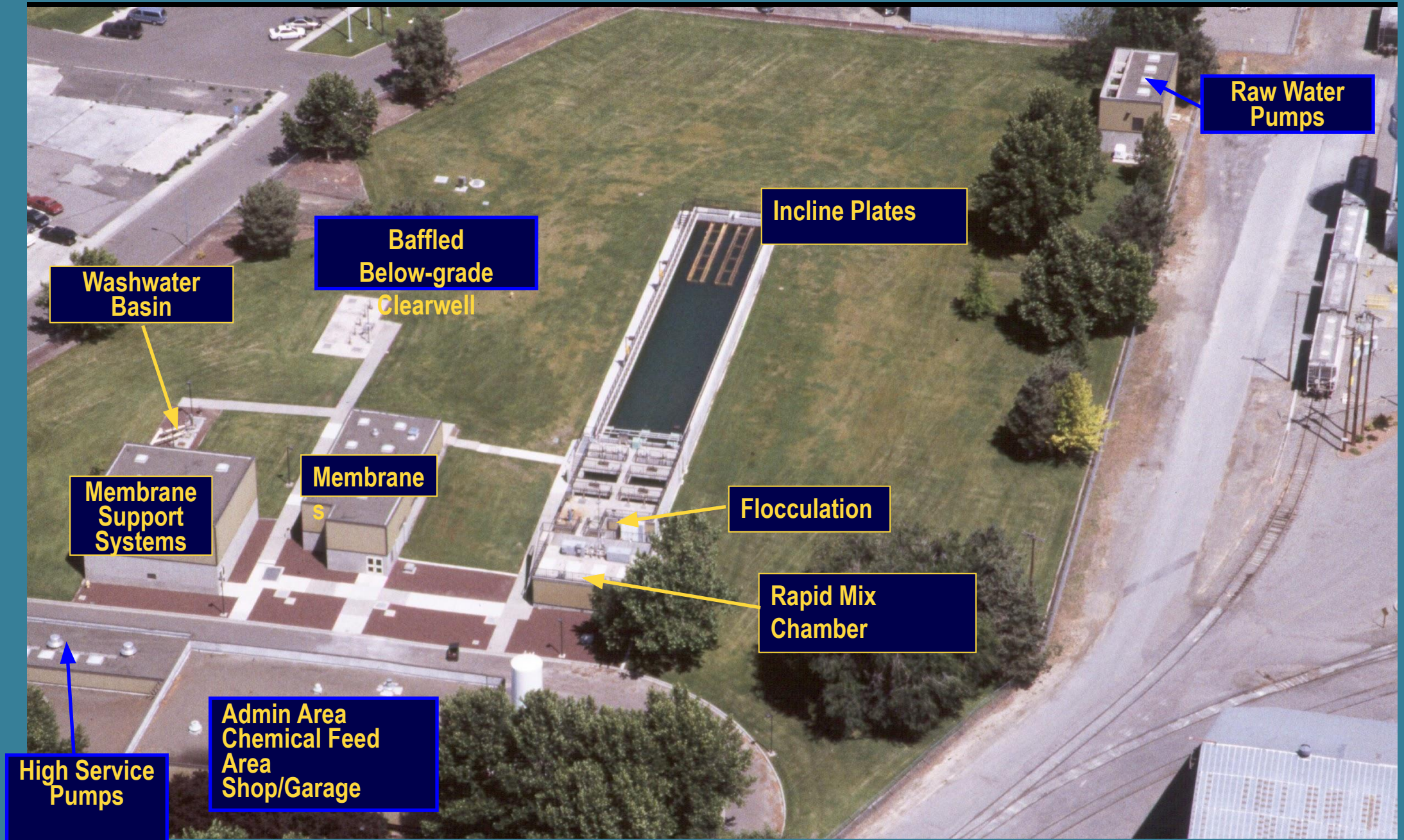
- Turbidity: 0.5 NTU, spikes up to 20 NTU
- Total organic carbon: 0.7 - 4.0 mg/L
- Alkalinity: 45 – 75 mg/L as CaCO_3
- Hardness: 45 – 90 mg/L as CaCO_3
- pH: 7.3 – 8.6
- Temperature: 2 – 22 deg. C

Columbia WTP

- Constructed in 1978
- Seasonal 7.5 MGD conventional filtration plant
- Major renovation from 2004 – 2007
- Retrofit submerged membranes into existing filter basins
- 7.5 mgd membrane filtration by 2005
- 15 mgd capacity by 2007
- 20 mgd ultimate capacity
- Recently completed a two-year long renovation







Converted Filters

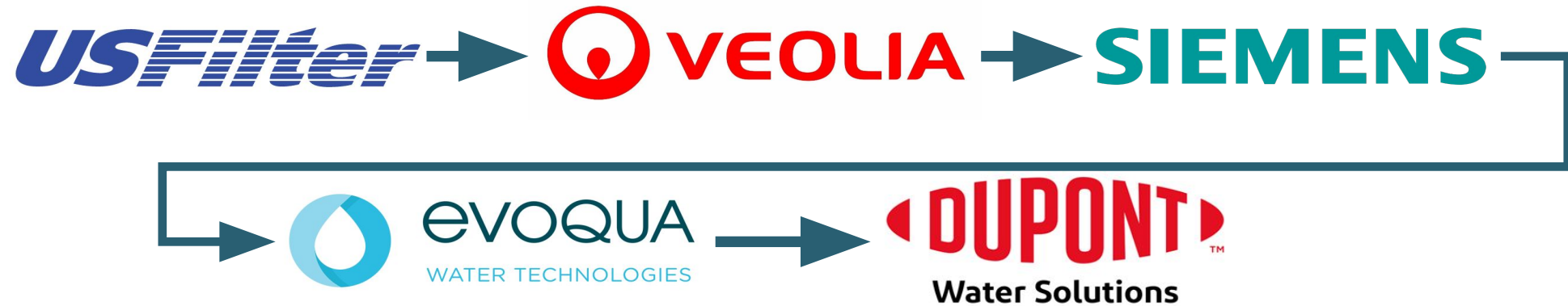


Memcor Membrane Rack with a Blank Space



Membrane Condition and Warranty

- Each set of membranes procured with 10-year warranty
- Guaranteed membrane replacement pricing for 20 years – through June 2024
- Installed with Memcor S10V membranes



- All membranes replaced once already with S10N modules

Item	Unit	Value
Backwash interval	minutes	38 (fixed)
Pressure decay test interval	hours	24
Filtrate pump maximum capacity	gpm	3,800
CIP (citric acid & hypochlorite)	hours	720
CIP heater	-	Was non-operational / off (Just replaced)
Acid CIP	-	0.5% citric acid @ pH 2.3
Hypochlorite CIP	-	800 mg/L
Chemically enhanced backwash	-	None

Operational Setpoints

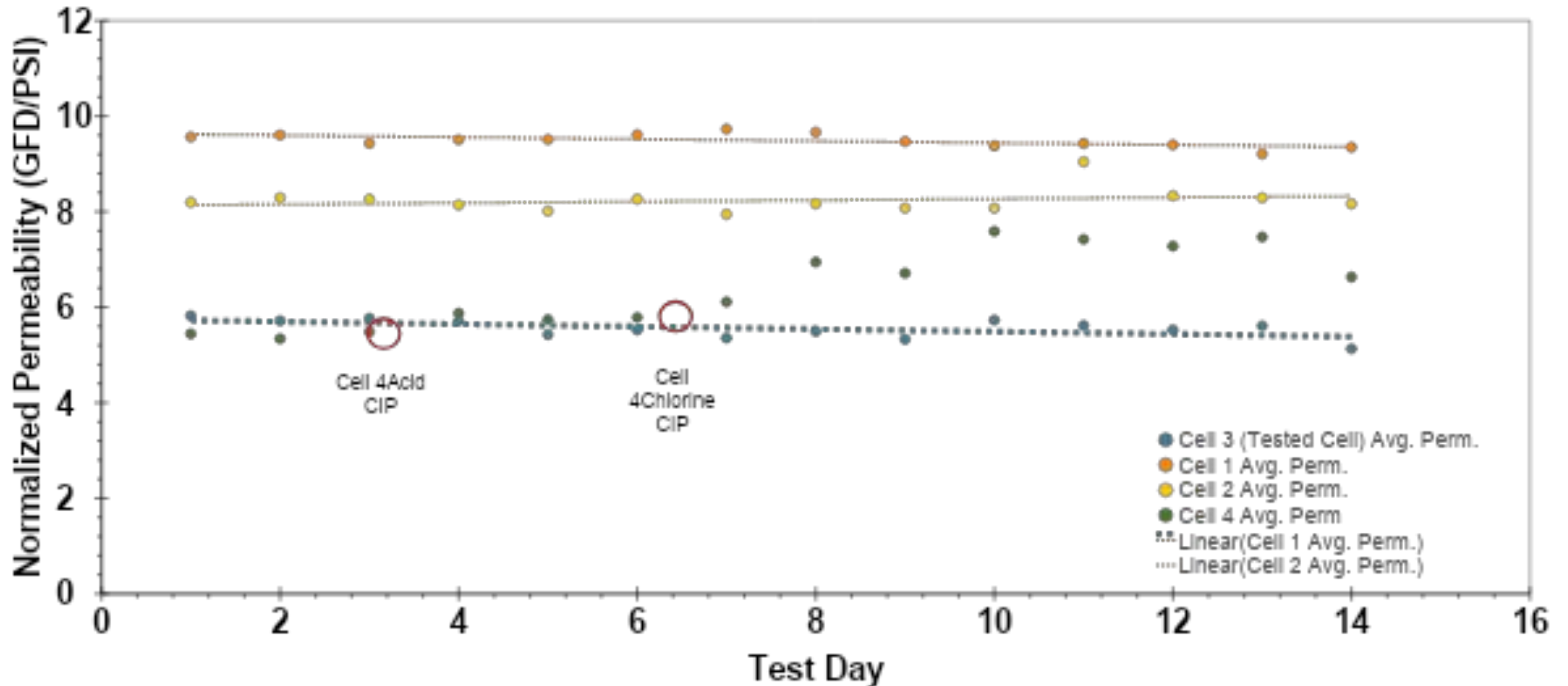
Comprehensive Membrane Optimization Effort

- Goals
 - Reduce backwash waste water generation
 - Increase plant recovery rate
 - Decrease plant energy consumption
- Change different plant setpoints
- Success criteria
 - No steep TMP increase during test period
 - Permeability decrease $\leq 10\%$ during continuous operations



Increased Duration Between Backwashes for Cell 3

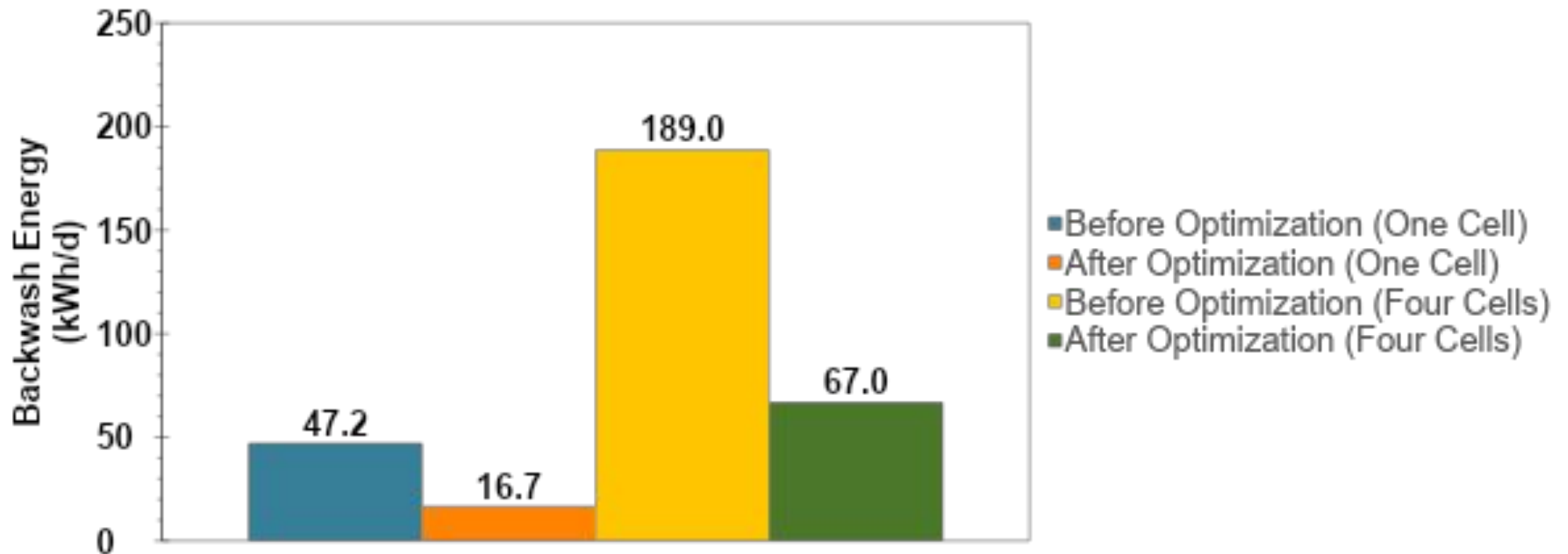
Permeability Declined 3%/week



Energy Consumption Savings

Optimized backwash will save the whole WTP 122 kWh/d in electricity.

Calculated energy savings is \$172/month @ 4.71 ¢/kWh.



Membrane Conditions

- All membranes are very “old”.
 - Cells 1 and 2: 7 years
 - Cells 3 and 4: 10 years
- Must be changed out.
- Year 19 on 20 year guaranteed membrane replacement pricing
- Demand approaching WTP capacity
- Dupont has a new membrane to consider



Renovation

- Equipment is ~20 years old
- Tired despite regular maintenance
- Some equipment no longer supported
- Installation / replacement during winter while plant is shut down
- Utility procurement is key



Hypochlorite System



- Existing tanks were leaking.
- Chlorine feed pumps poorly configured.
 - Diaphragm pumps mounted too high.
 - Could not draw down entire tank contents.

CIP Room



- CIP heaters have failed
- One of the CIP tanks had heat damage from the heaters
- Decades of incidental chemical leaks have damaged concrete

Hydraulic Transient Protection



- Old Surge Tank Inside High Service Pump Room
- Second Surge Tank Placed Outside

Permanganate Room



New coatings, piping,
safety features

Membrane Replacement

- Surface prep and coat filter boxes
- Change from Memcor S10N to S10Nv2 membranes (+52 ft²)
- Removing spacers from the filter cells
 - 448 to 576 membrane modules/cell
 - Increasing capacity from 15 mgd to 20+ mgd
- System recovery = 96.2% @ 10 deg. C.



Filter Pipe Gallery



- Surface prep and recoat major piping, valves, and pipe supports
- Install inline CIP heaters
- New (upsized) filtrate pumps
- New turbidimeters

Pumping Stations



- Low lift pumps
- Backwash pumps
- High service pumps
- VFDs
- Programming

Perspectives from 20+ Years of Membrane Operations

- Filtered water quality is superb.
- More forgiving to changing raw water quality conditions.
- Mechanically complex process that needs a lot of routine maintenance.
- Aging membranes are more labor intensive than aging sand filters.
 - A lot of effort is spent to find and block off broken membrane fibers.
- Long-term use of cleaning chemicals damages structures due to incidental leaks and spills.
- Ready to go for a while!

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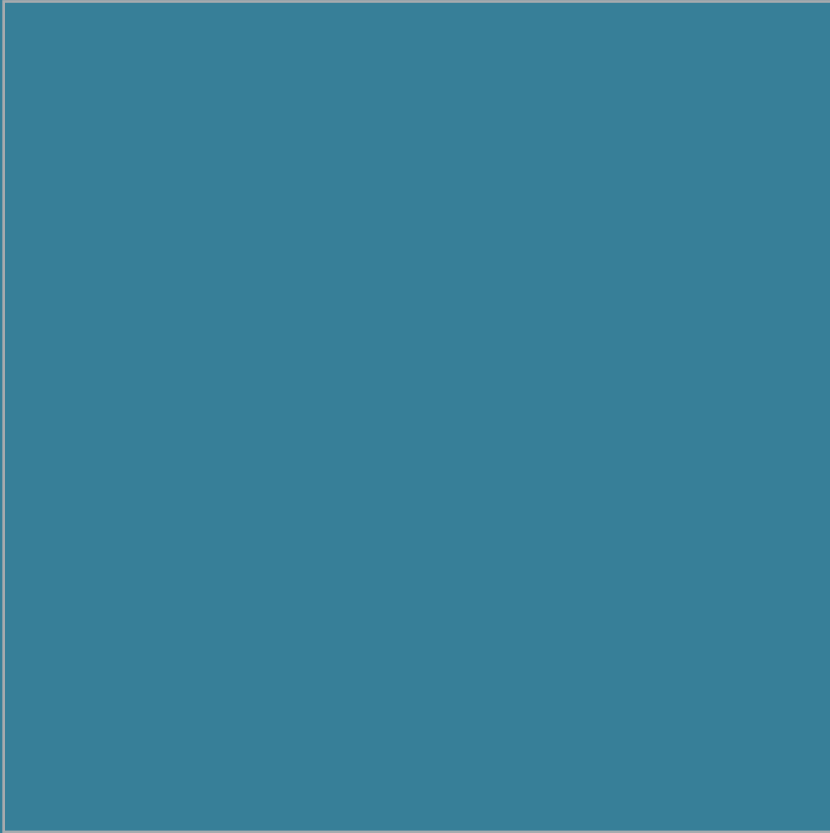


Date



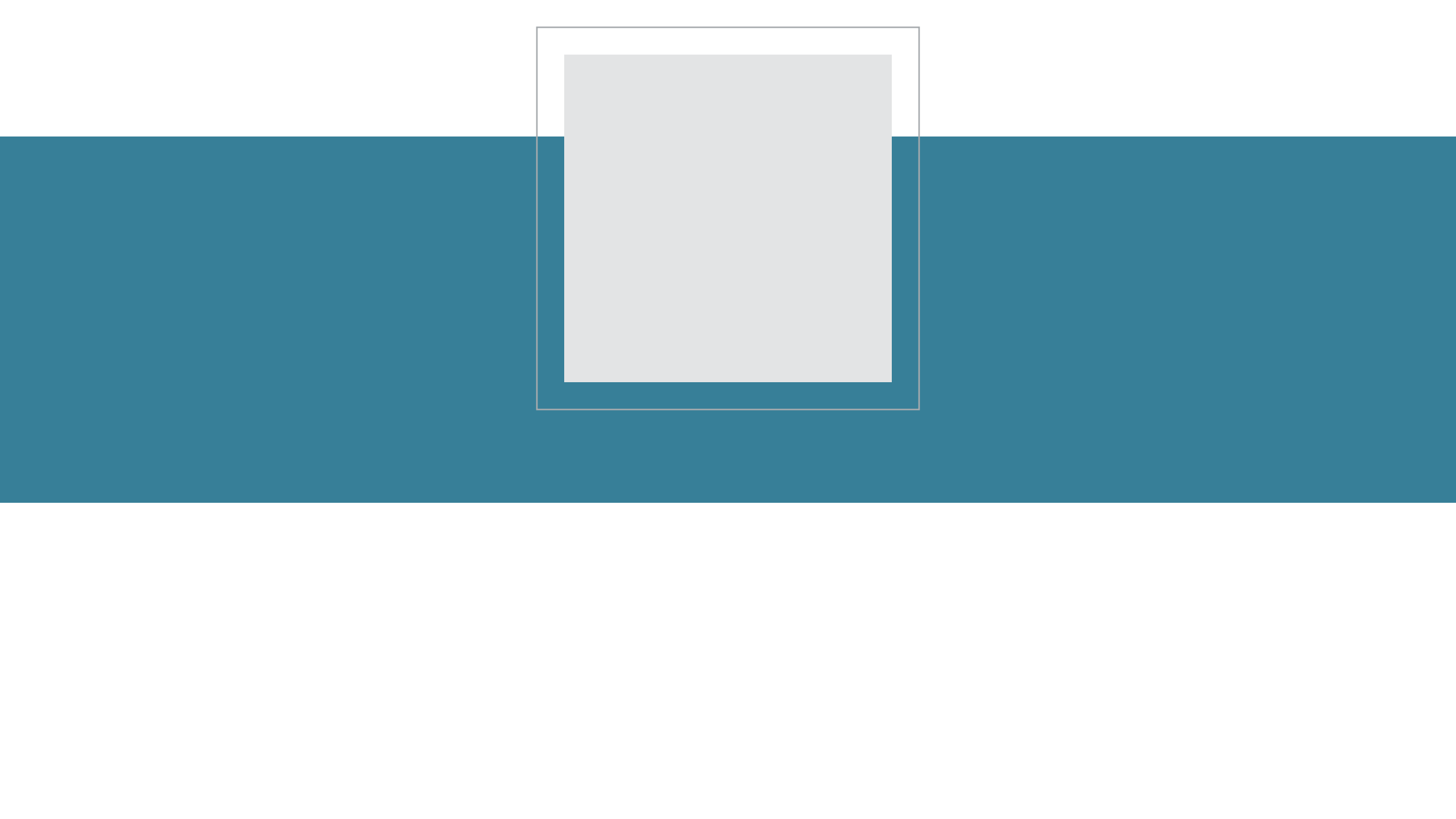
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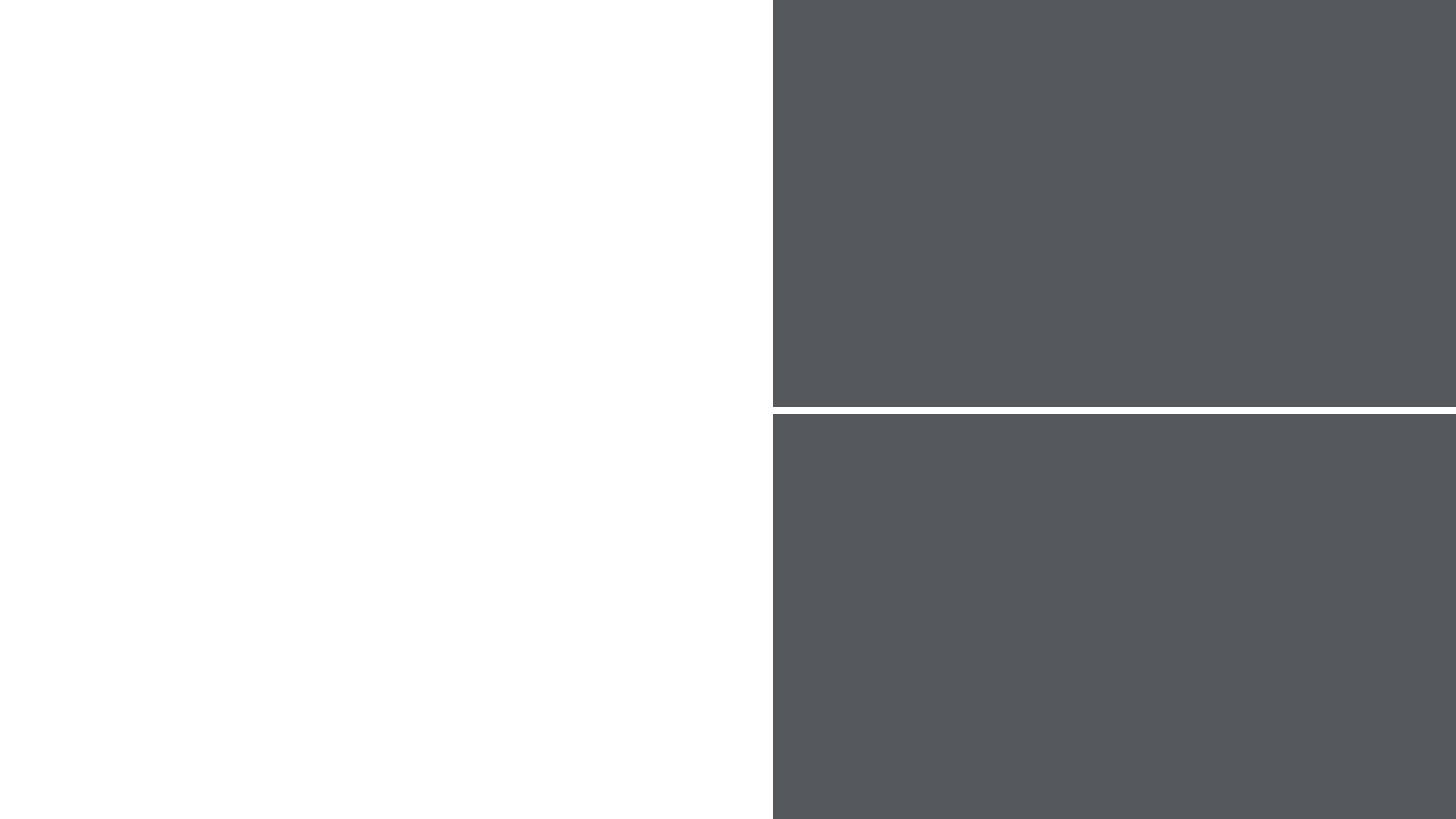


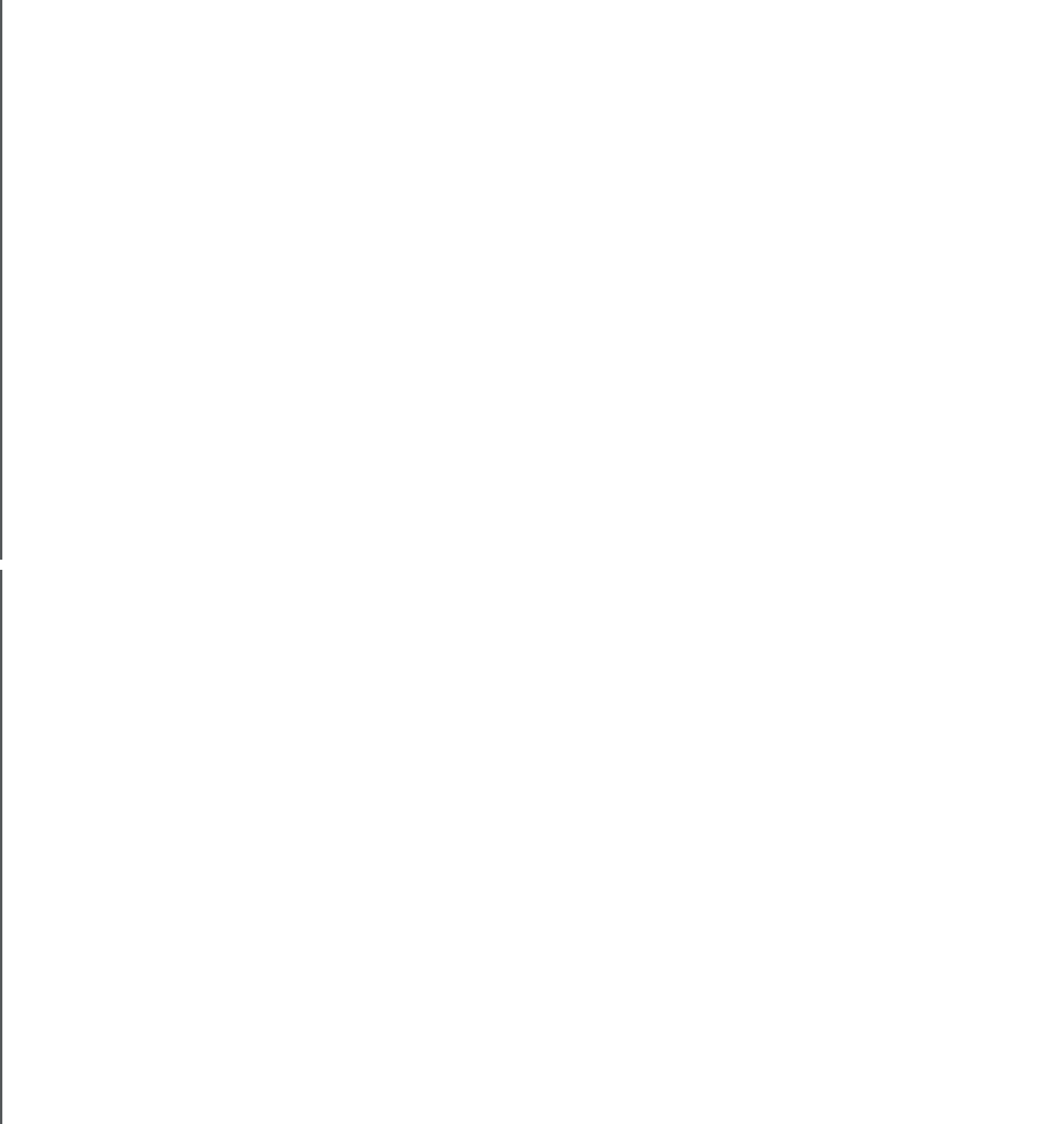
Agenda





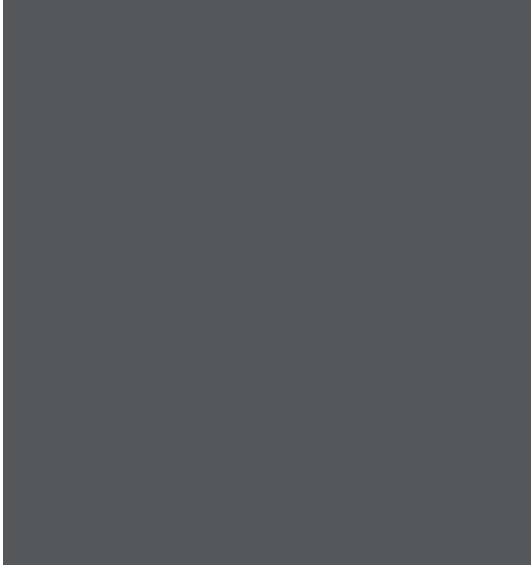
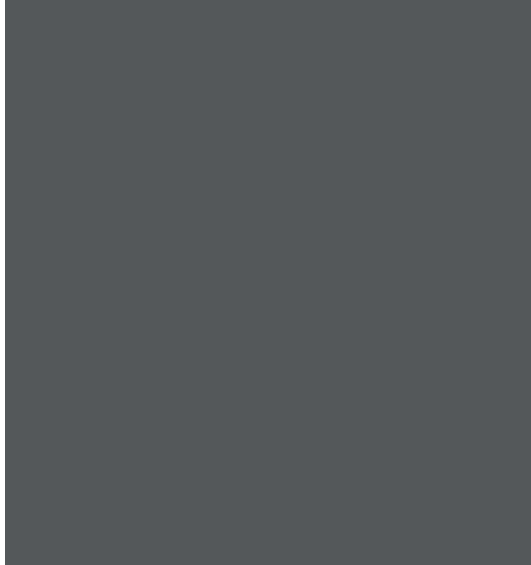
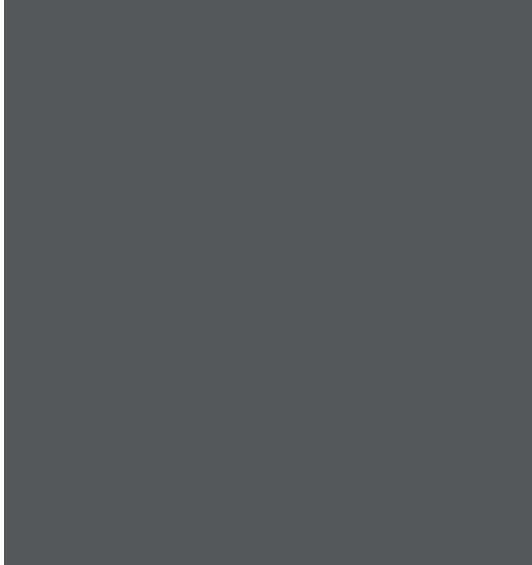






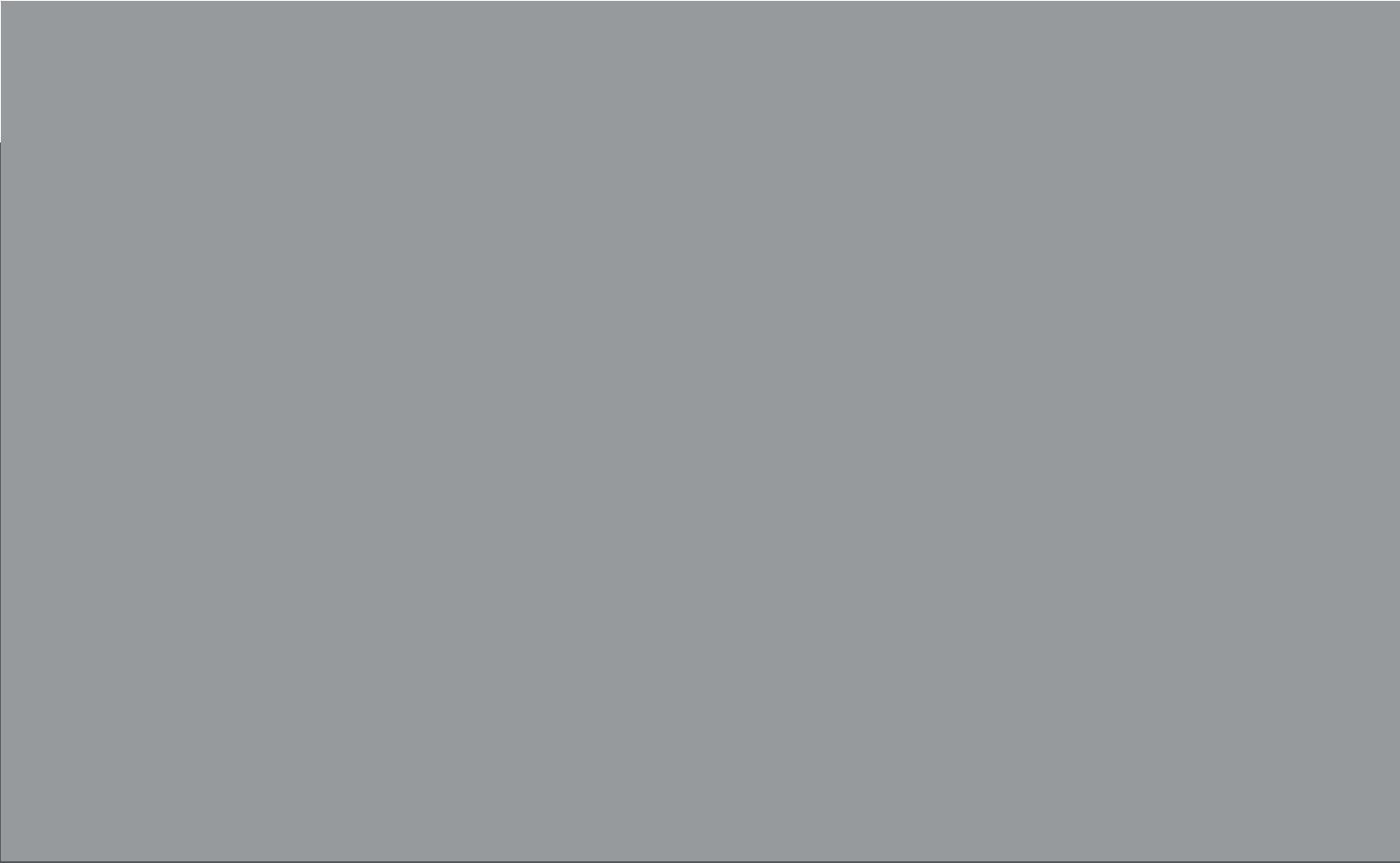








Project Name
Location



Project Name
Location

