



# Process Optimization Saves Money and Unlocks Capacity

**National Association of Clean Water Agencies**

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**Brown and Caldwell:** Eric J. Wahlberg

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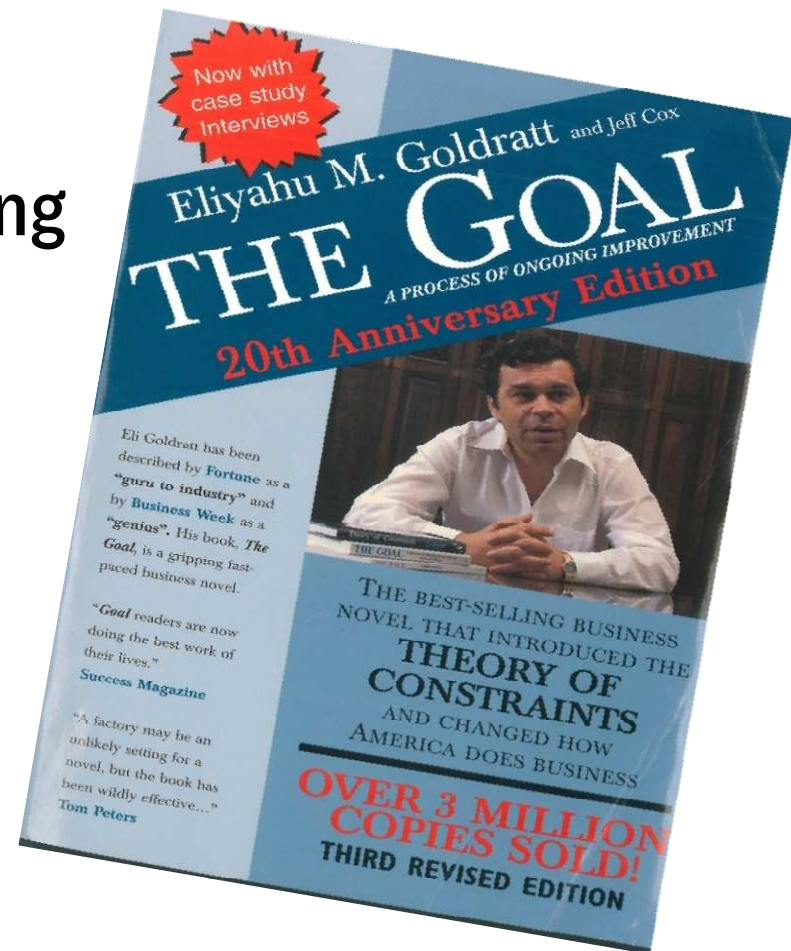
BROWN AND CALDWELL

# A challenge to look at operating wastewater treatment plants differently

- 1. Define the Goal**
- 2. Describe the three steps to achieving the Goal**
- 3. Results from the Metro (Denver) Wastewater Reclamation District**
- 4. Results from Metropolitan Sewer District of Greater Cincinnati**

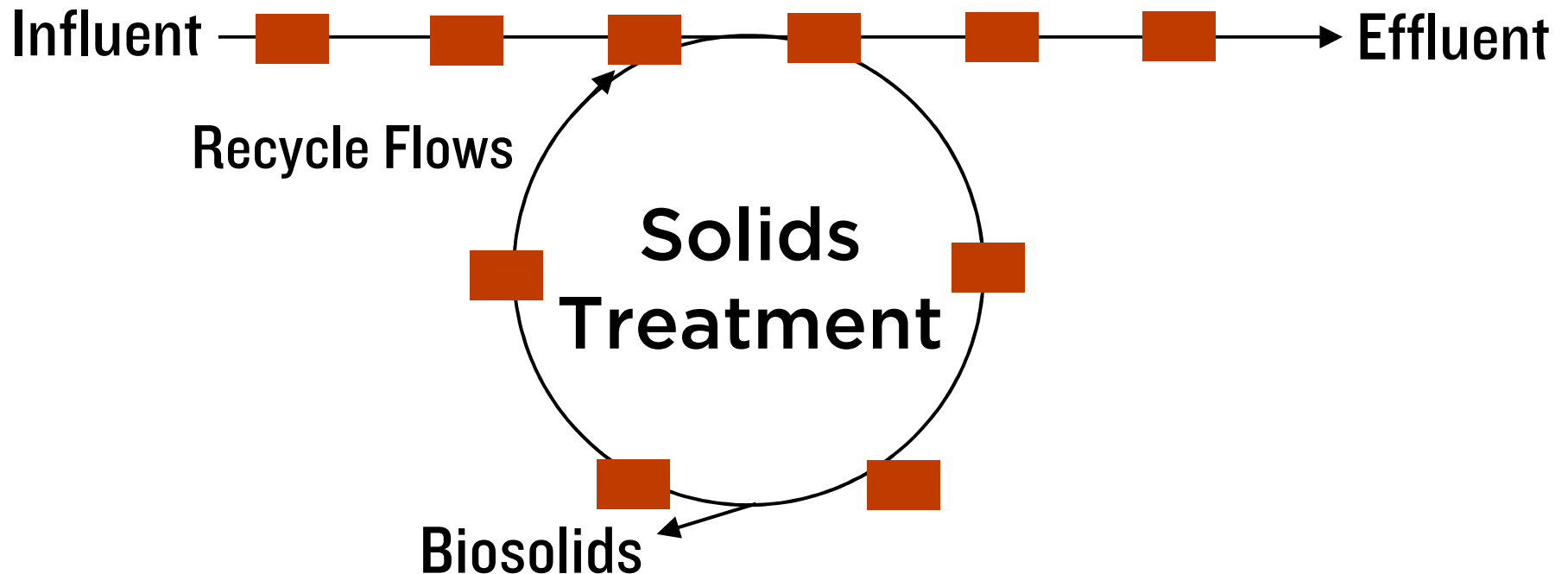
# The GOAL defined

The goal of any manufacturing plant is to make as much money as possible.

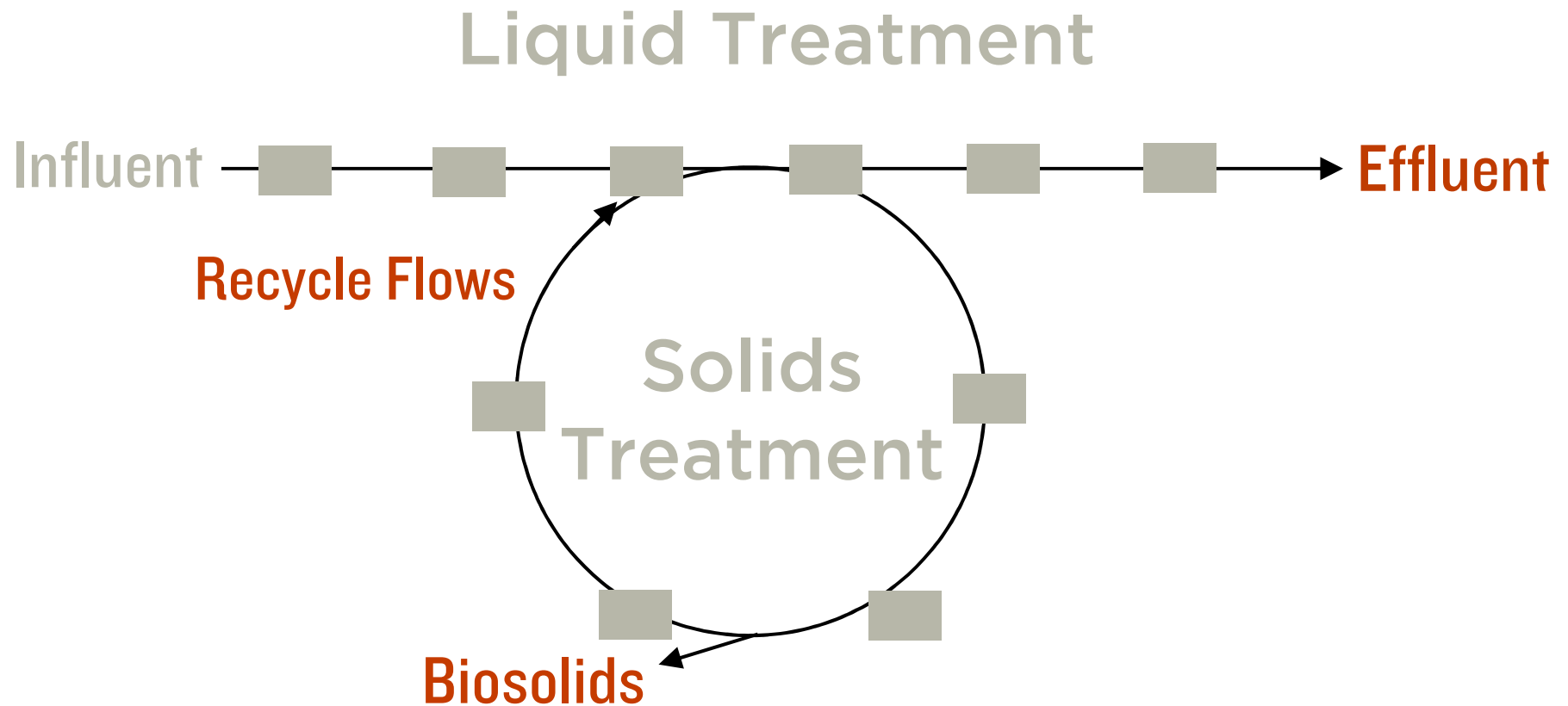


**Like a manufacturing plant, treatment plants are made up of multiple unit processes,**

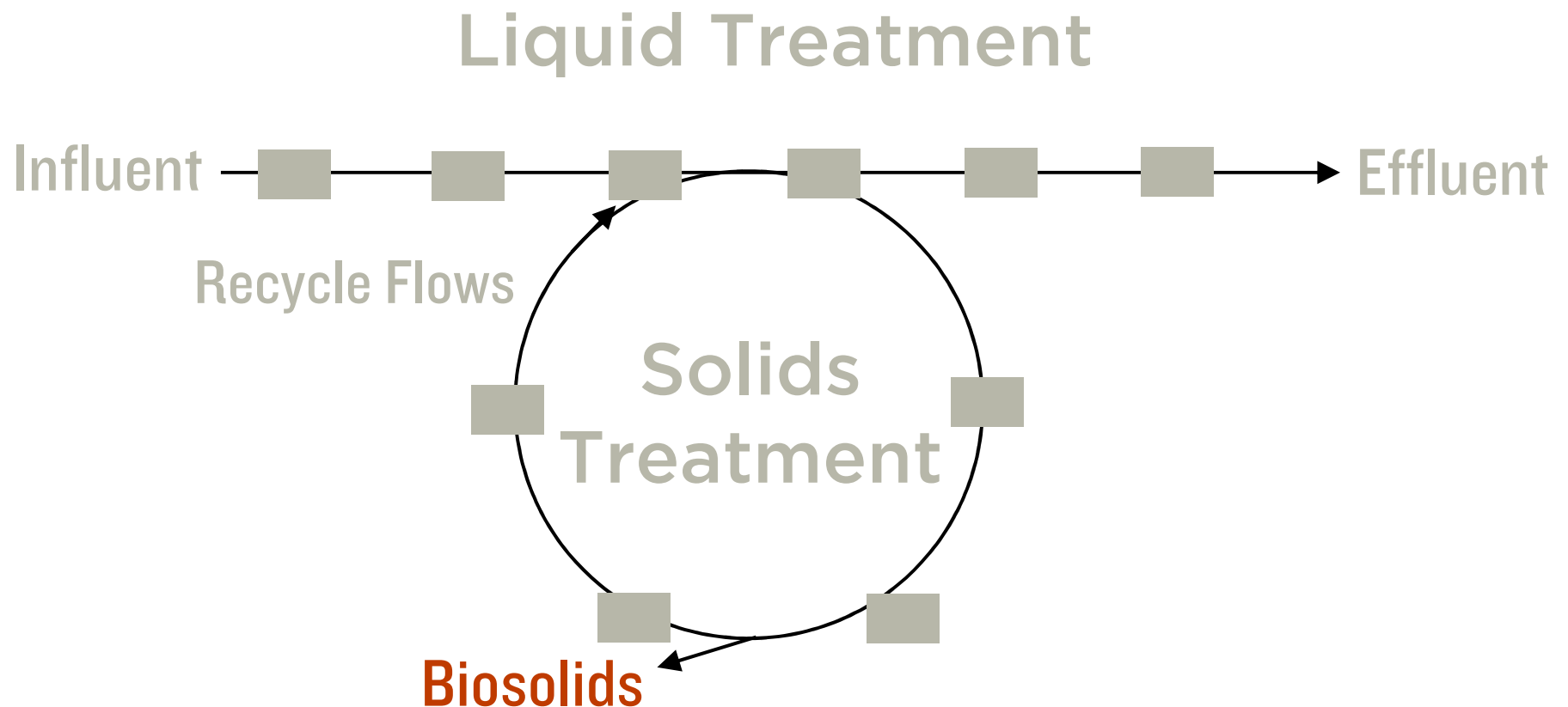
## Liquid Treatment



# But what is it that treatment plants produce?



# We produce biosolids



The GOAL of wastewater treatment:  
*. . .it's not this simple anymore*

**“To make permit.”**

# The GOAL of wastewater treatment is very different today

**“Remove pollutants from the incoming water—making the effluent permit compliant—and convert them to safe, disposable biosolids as sustainably and cost effectively as possible.”**



# Three steps to achieve the GOAL

**Maximize Throughput**



**Minimize Inventory**



**Minimize Operating Cost**

# Throughput defined in “The Goal”

- **Throughput is the rate at which the system generates money through sales.**

# Applied to a wastewater treatment plant, throughput is a little different

- In maximizing throughput, operators must ensure that as much excess capacity as possible is available at any given time.

# Inventory defined in The Goal

- **Inventory is all the money that the system has invested in purchasing things which it intends to sell.**

# What allows us to treat wastewater?

We constantly refer to the following:

- Influent total suspended solids
- Primary clarifier solids removal efficiency
- Primary sludge total solids concentration
- Mixed liquor suspended solids
- RAS total suspended solids concentration
- Biological solids wasted; digested solids trucked
- Volatile solids destruction
- Solids capture efficiency

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- Volatile **solids** destruction
- **Solids** capture efficiency

# Solids are what go into our product (biosolids)

- Solids are a WWTP's "inventory"
- To minimize inventory, the mass of solids residing in each and every process unit at any given time must be kept as low as possible

Examples:

Low blankets in clarifiers

Lowest SRT possible

Minimal sludge "storage"

# #3 can't happen without 1 & 2; the first two ensure the third

Maximize Throughput



Minimize Inventory



Minimize Operating Cost

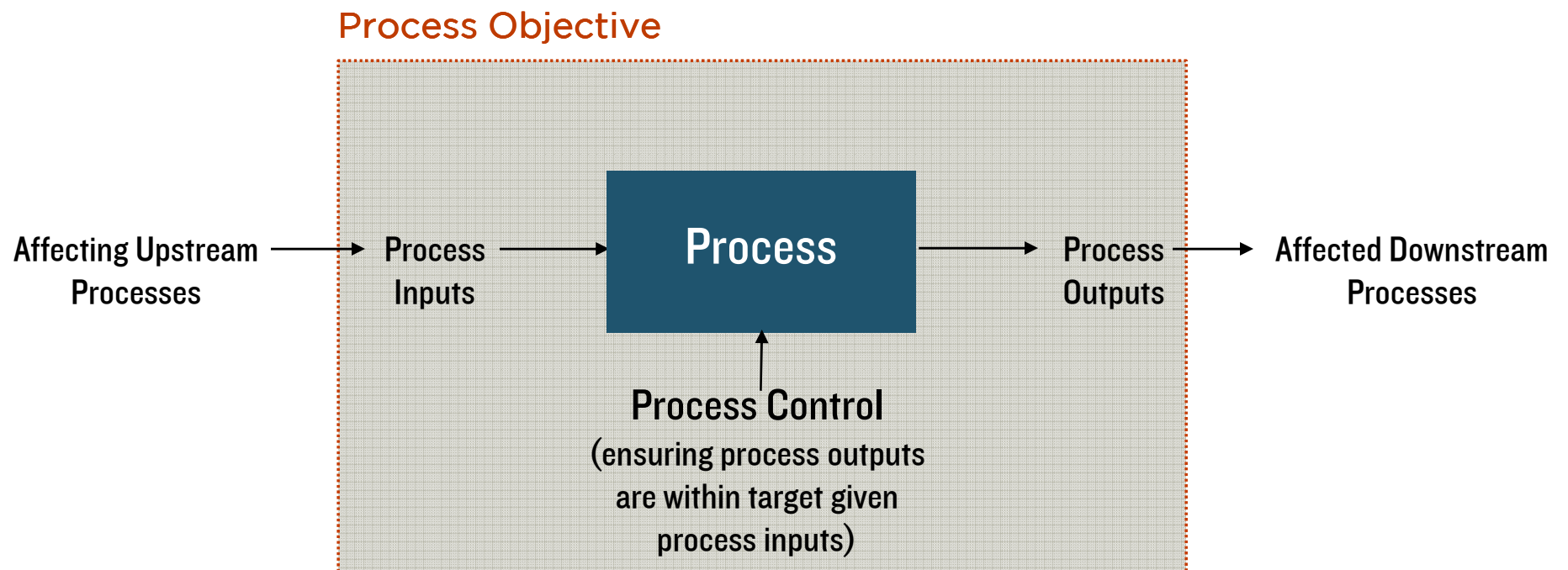


# Surviving a major upgrade by maximizing throughput

Robert W. Hite Treatment Facility, Metro Wastewater Reclamation District, Denver, Colorado



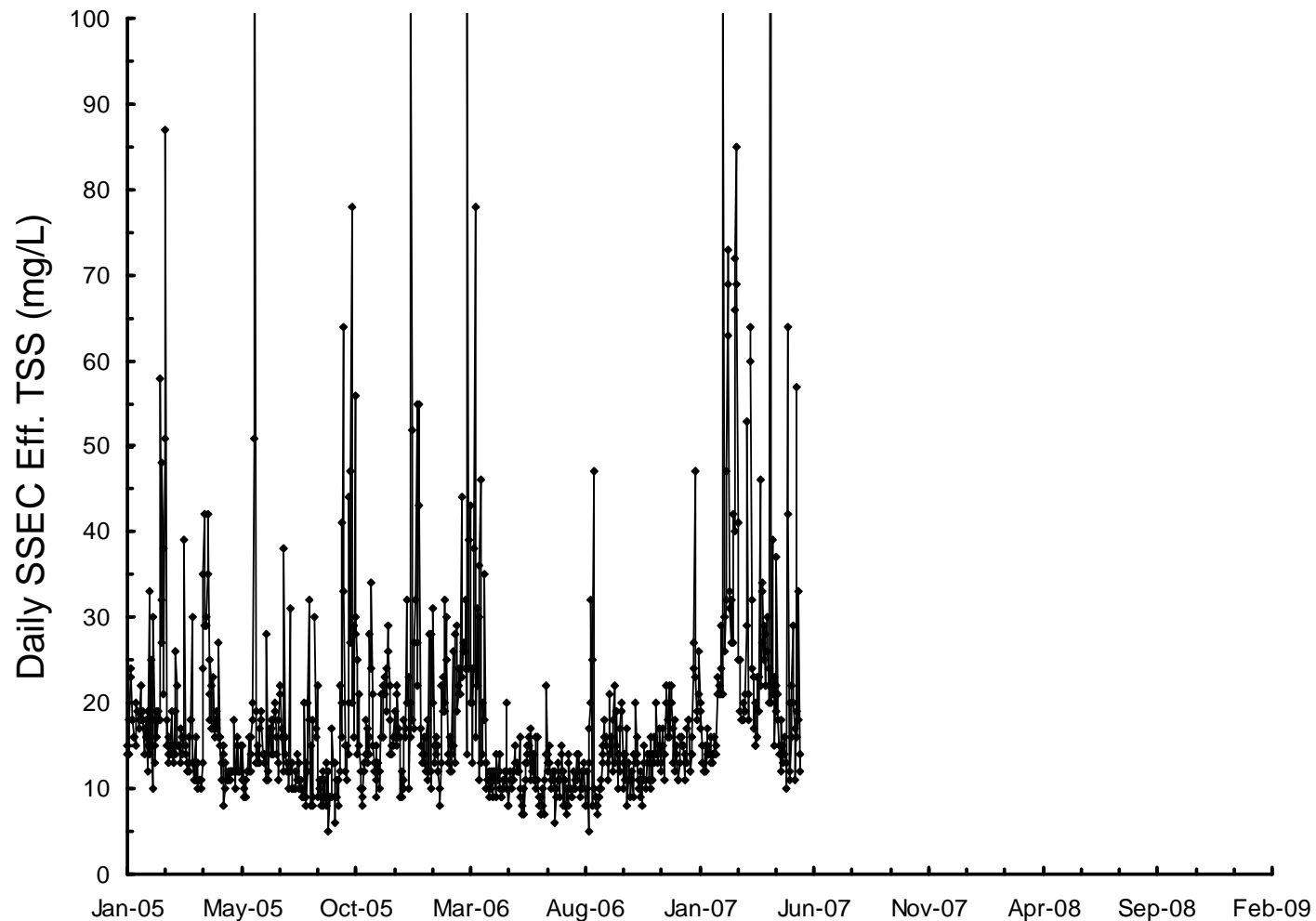
# Optimizing individual processes as part of whole



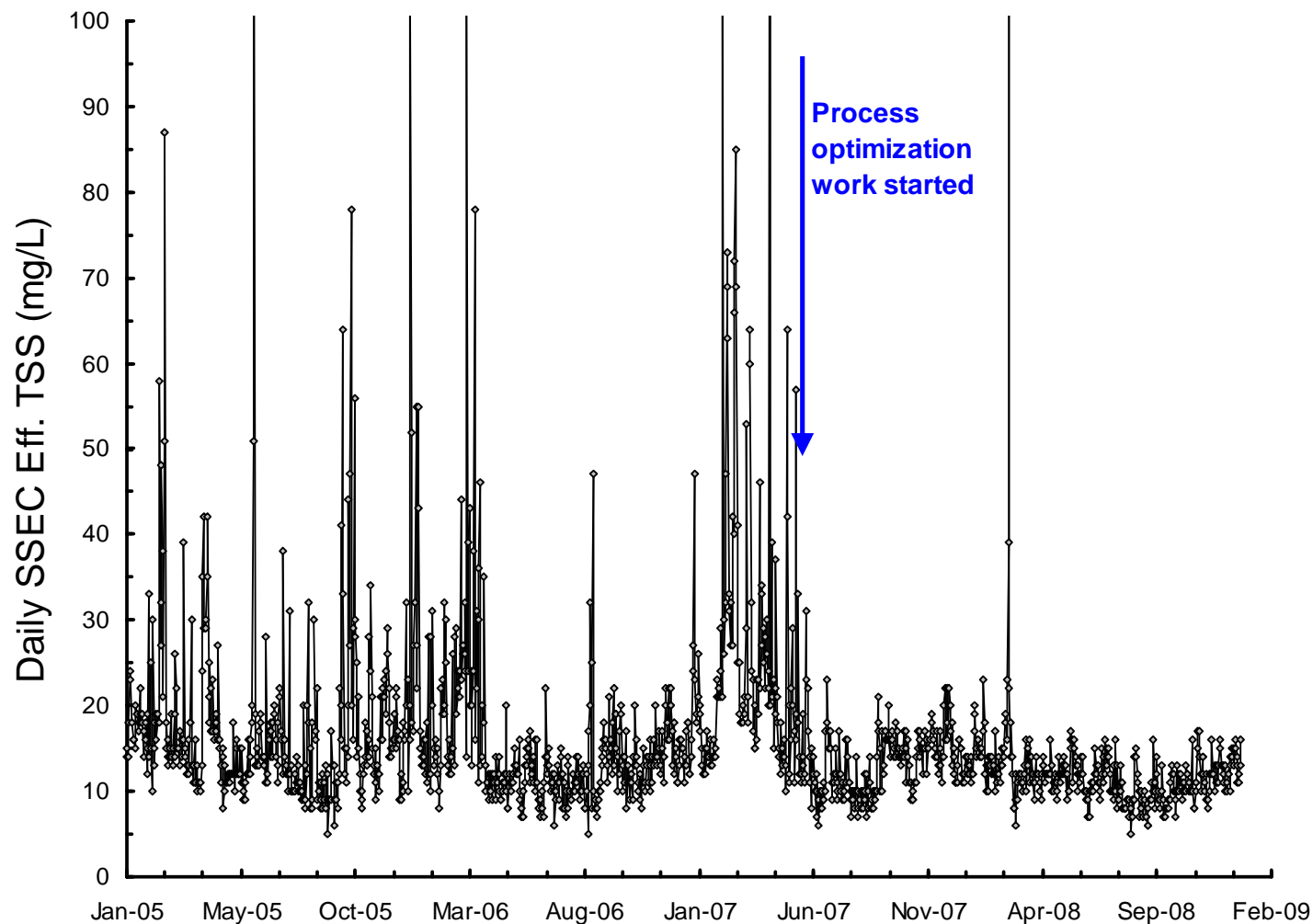
# MWRD strategies in South Complex activated sludge system

- Abandoned constant MLSS control and implemented MCRT control.
- Targeted lowest MCRT that gave BOD removal and best sludge quality but no nitrification (increased throughput and decreased system solids inventory).
- Implemented RAS control to keep low blankets (decreased secondary clarifier solids inventory).

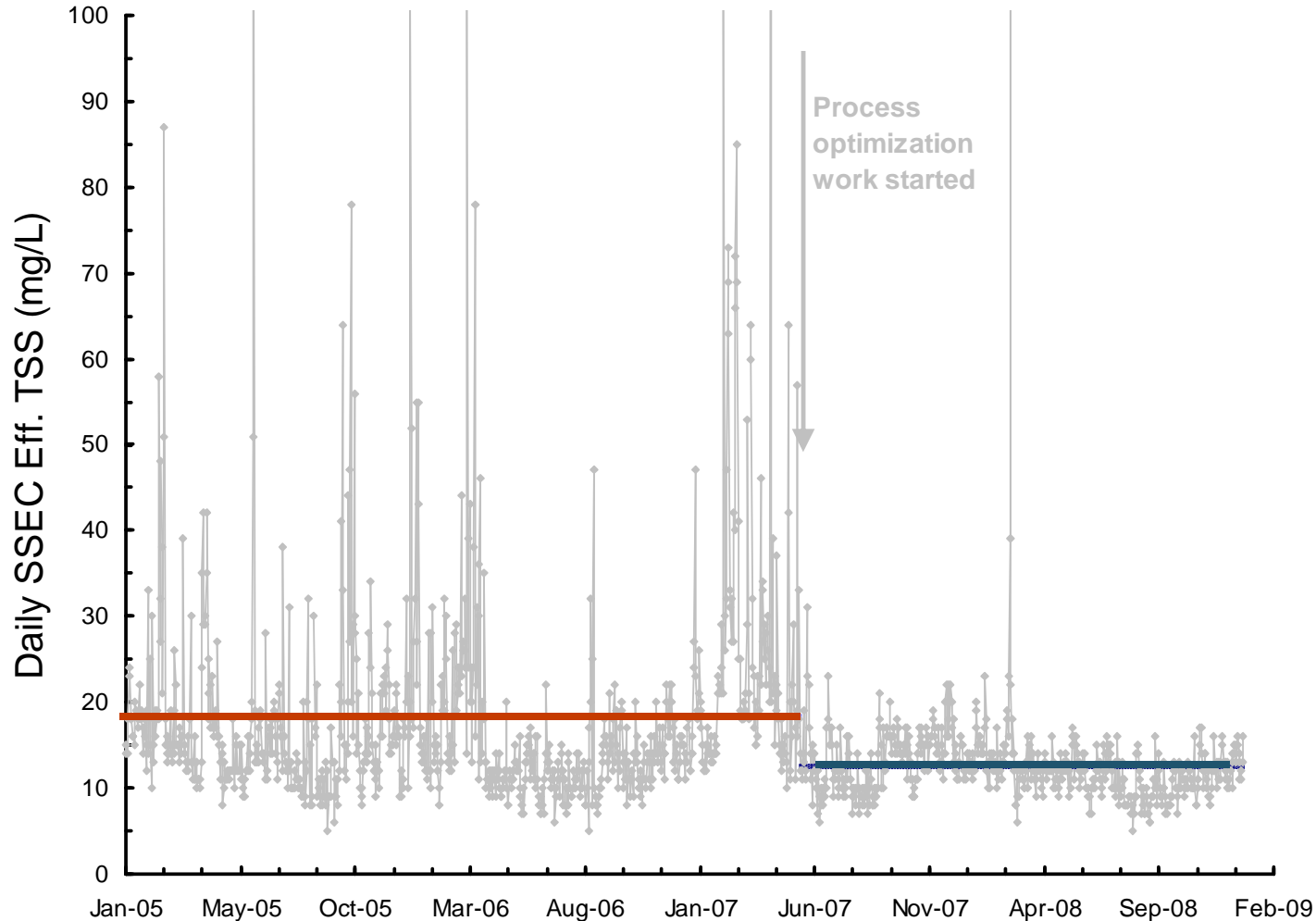
# Historic SSEC performance highly variable



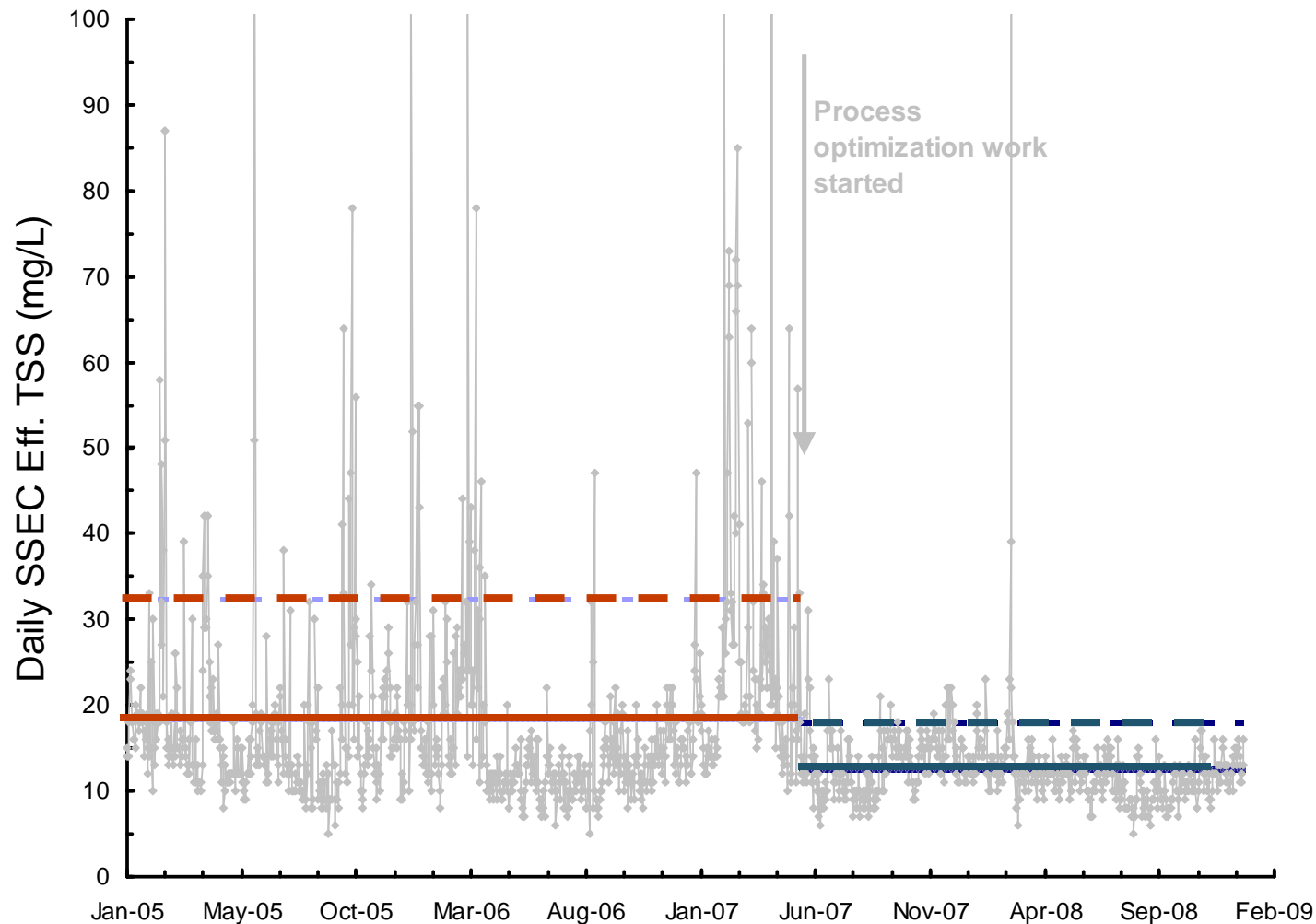
# Process optimization work initiated in May 2007



**Average TSS<sub>EFF</sub>: Before = 18.4 mg/L;  
After = 12.6 mg/L**

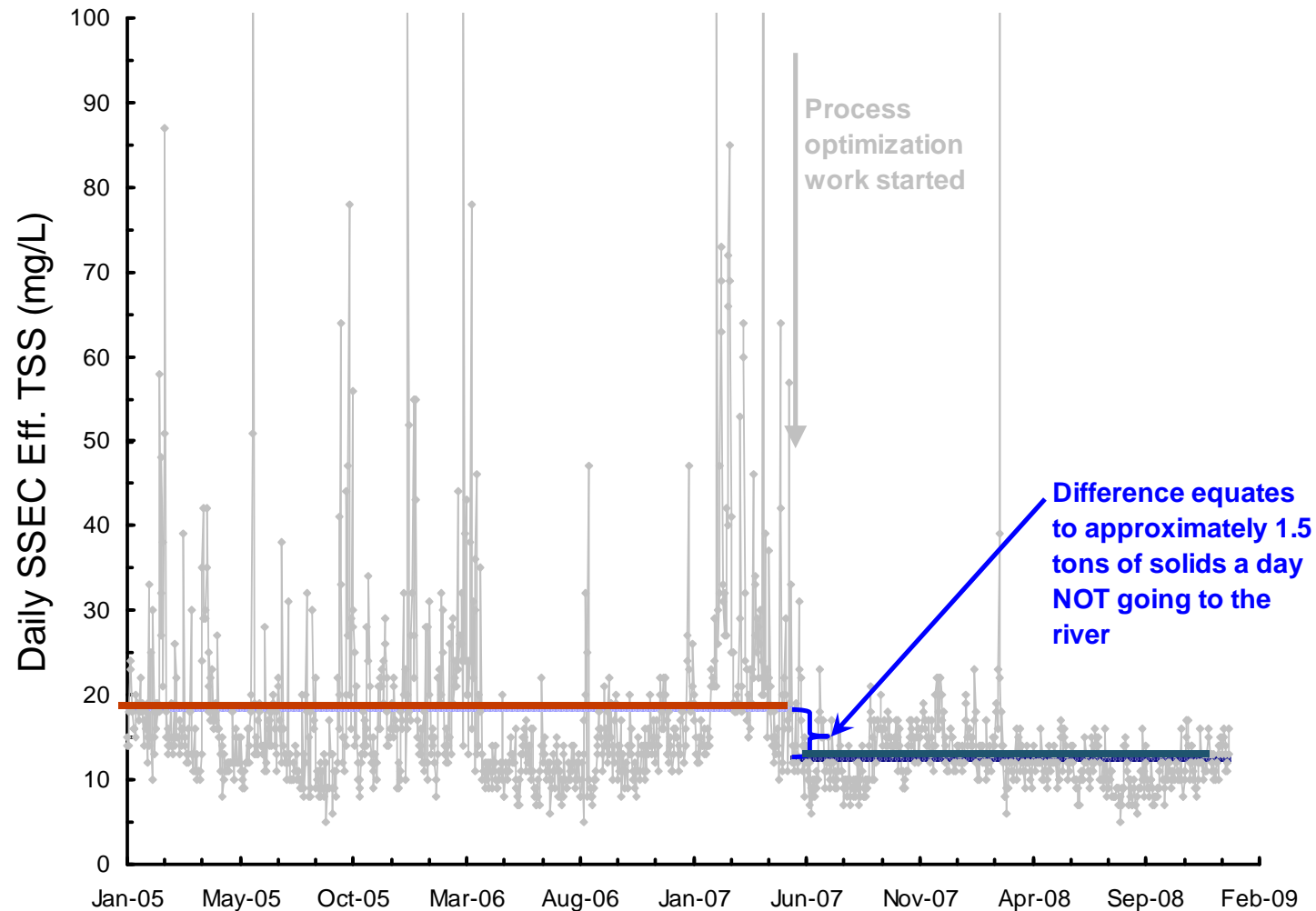


**Standard deviation: Before = 32.3 mg/L,  
After = 17.9 mg/L**



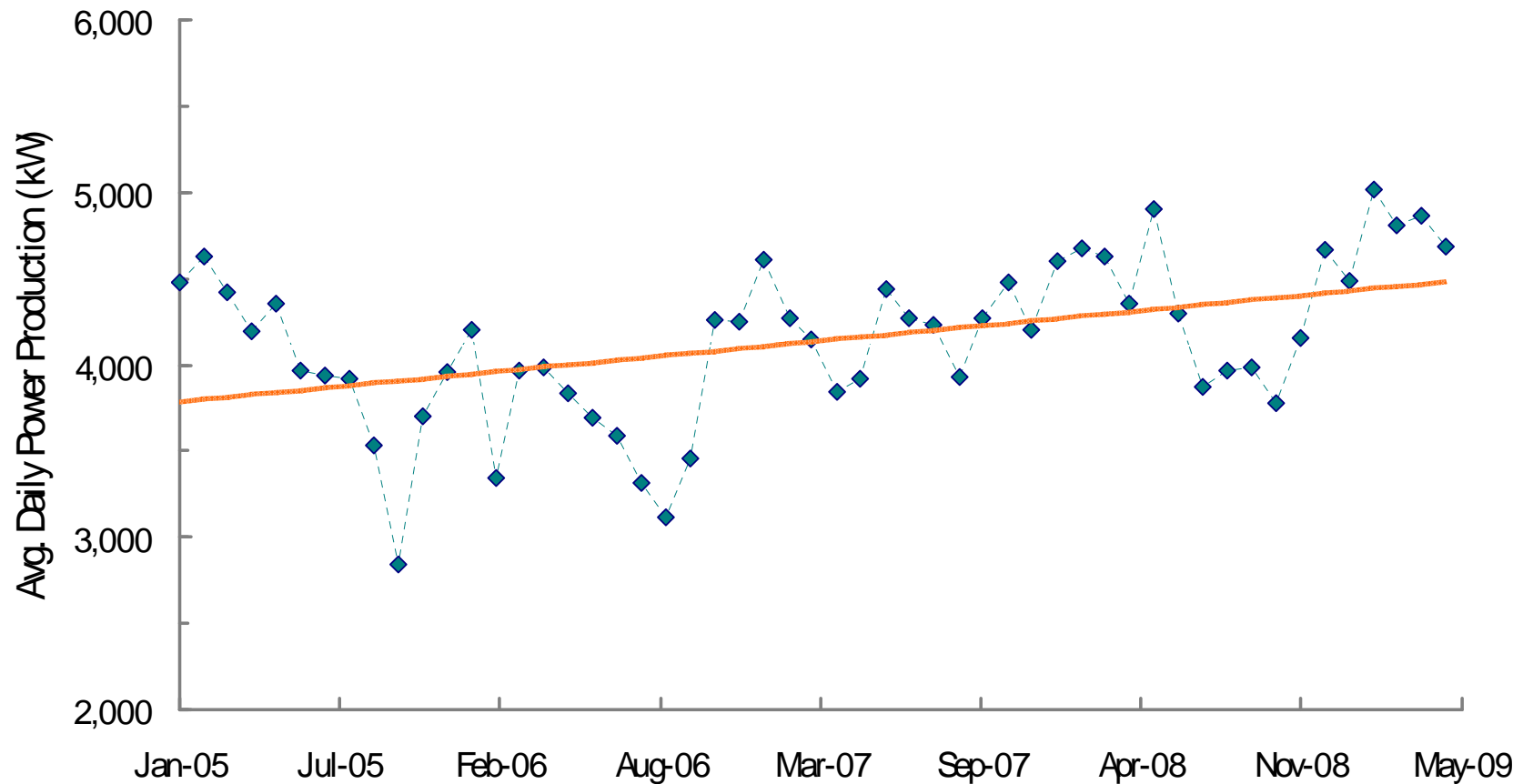


# RESULT: More capacity, easier operation, significant environmental improvement





# RESULT: Better solids capture equates to more power generated

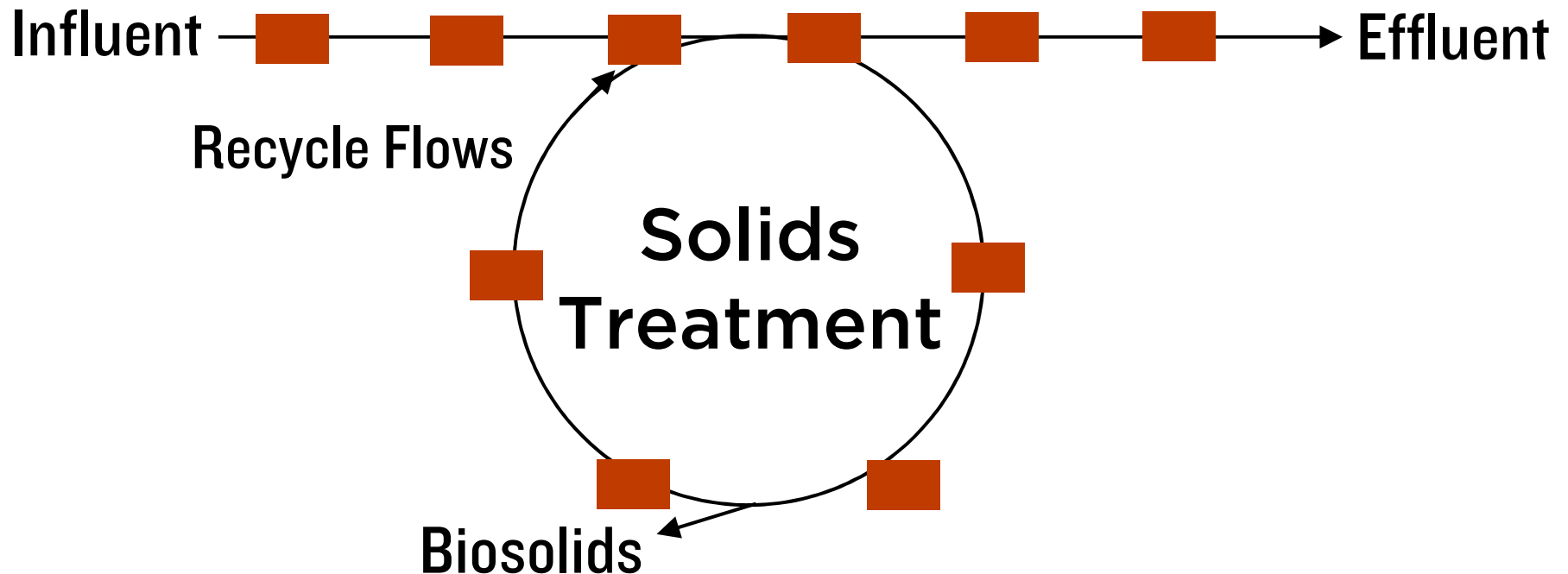


# MSDGC's Treatment Goal

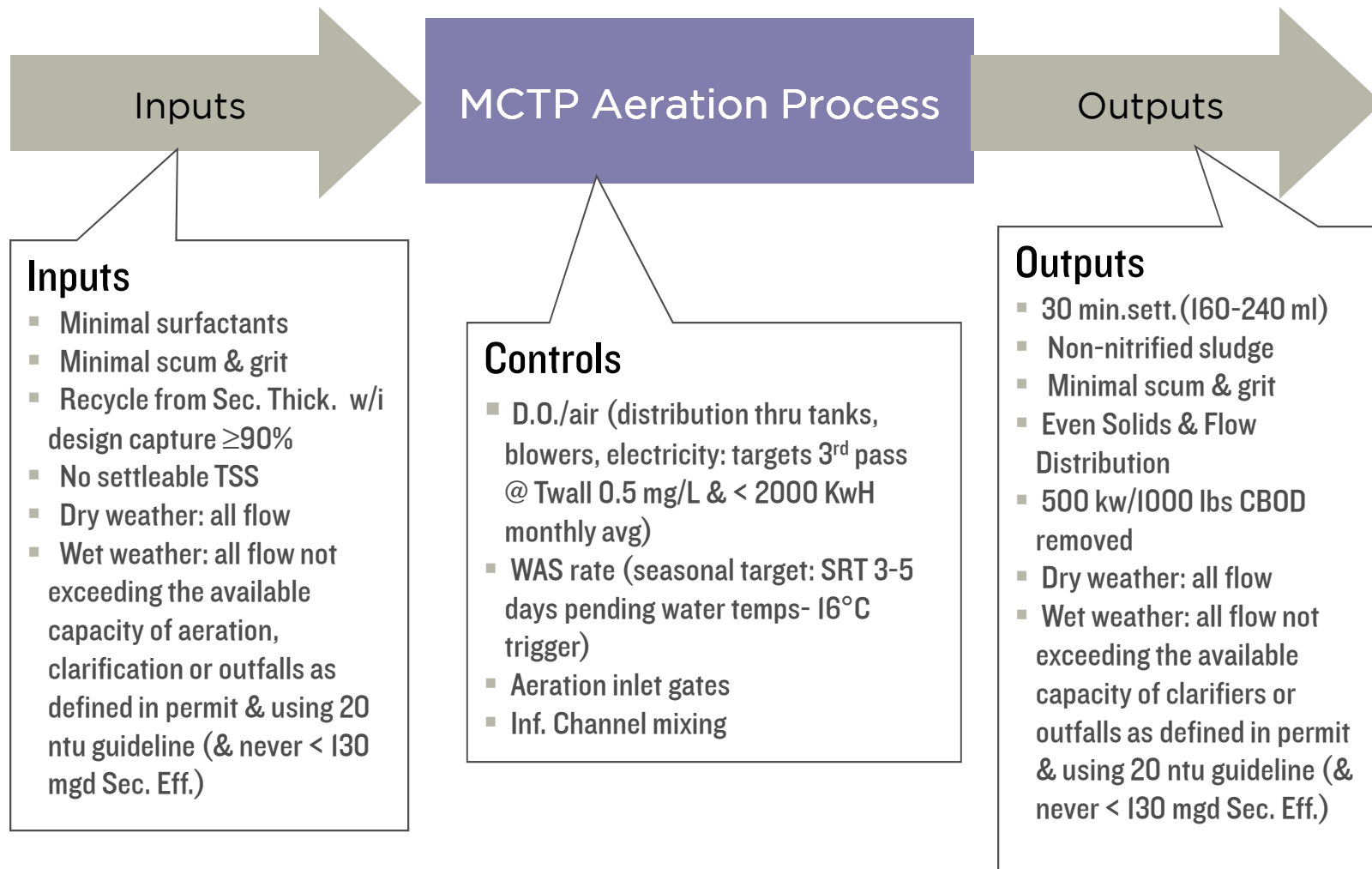
**Quality = Gold Award**  
**Cost = Lowest**

# Outputs are inputs to downstream processes

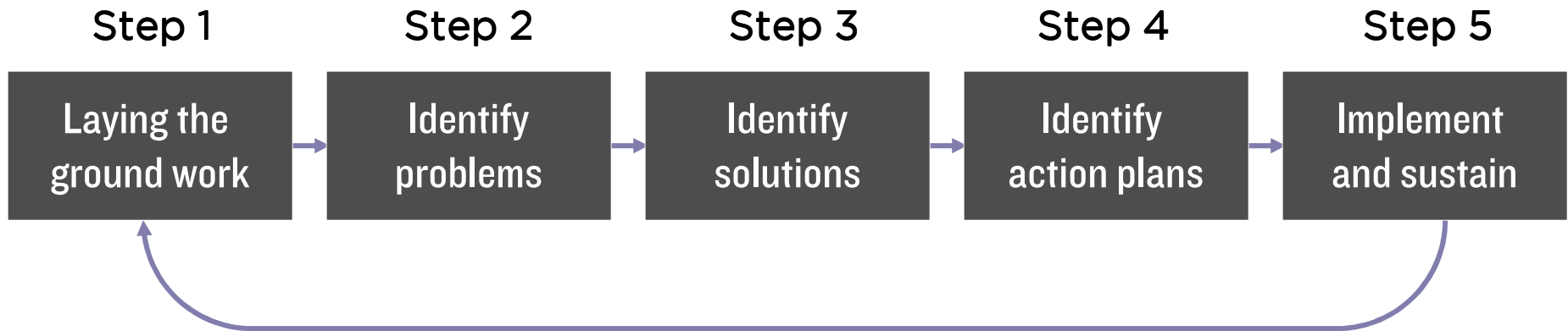
## Liquid Treatment



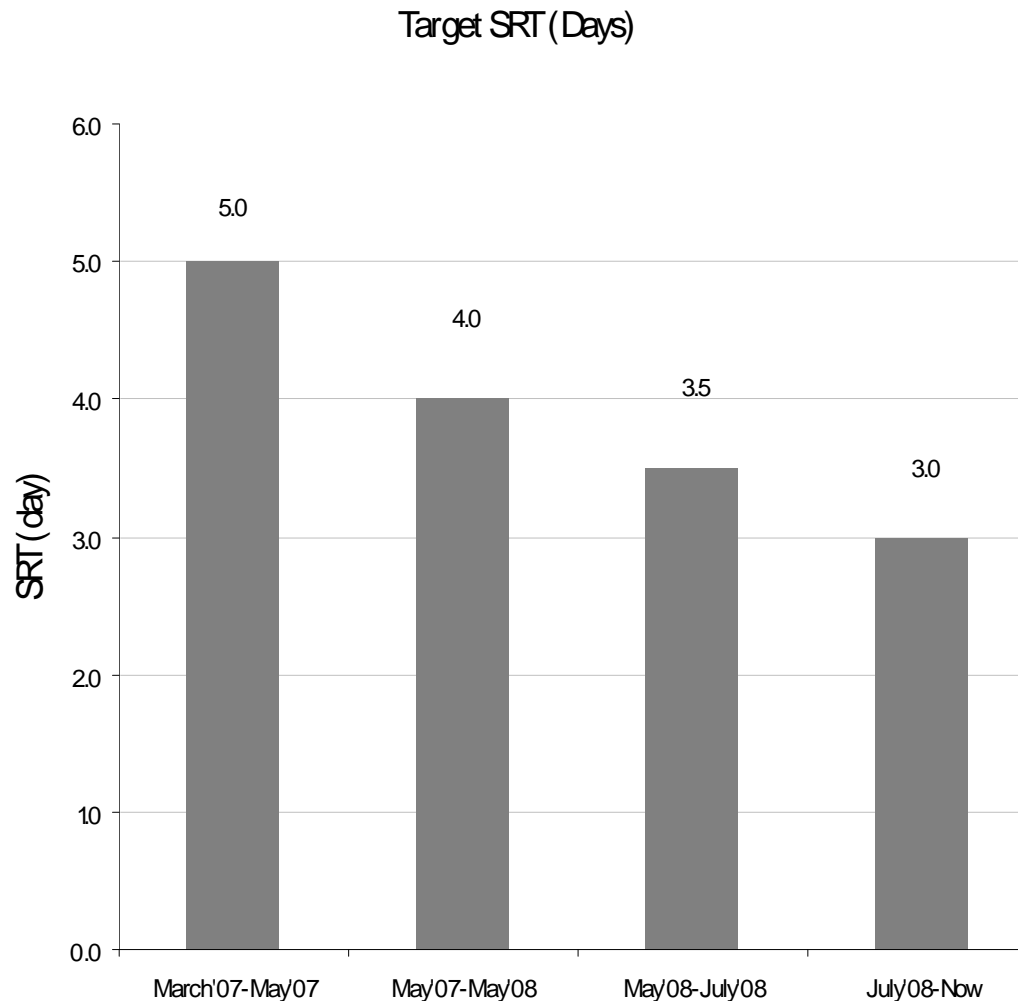
# Process Team Goal – optimize each individual process



# MSDGC's five-step continuous improvement process

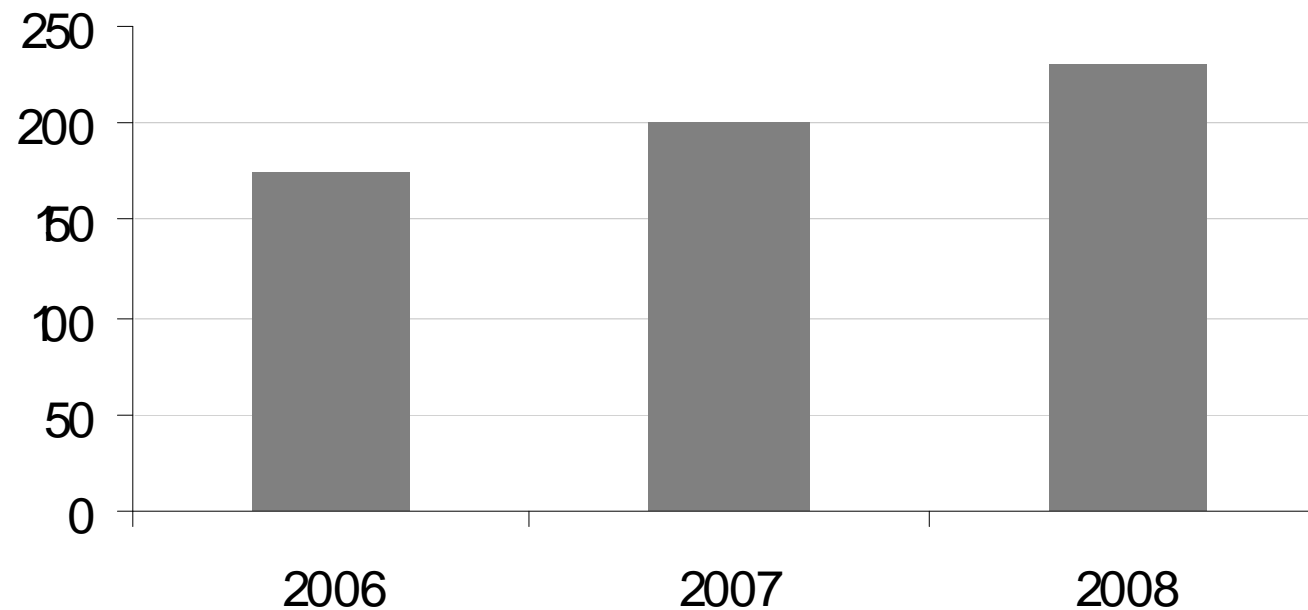


# ACTION: Reduced SRT to reduce inventory

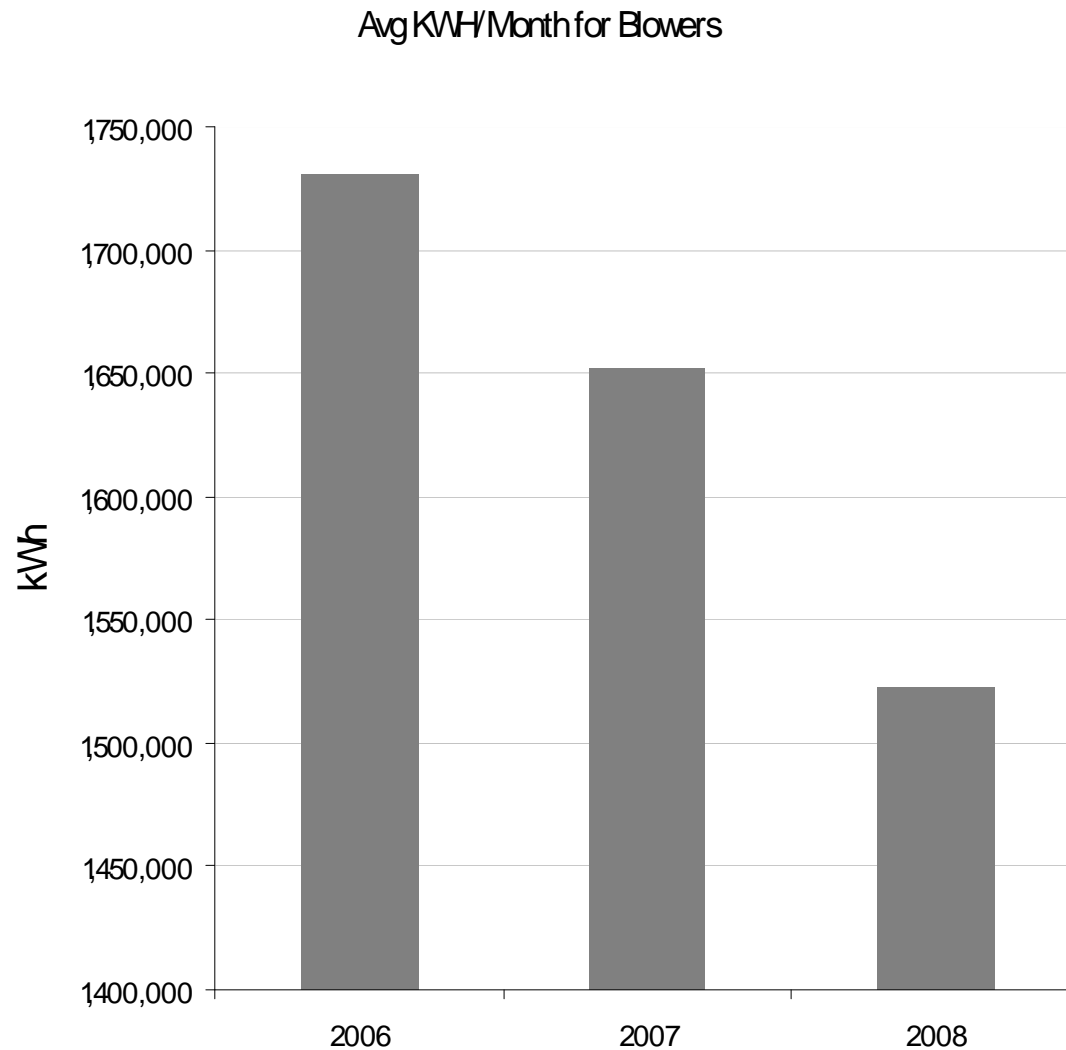


# RESULT: Increased throughput

**Secondary Flow**



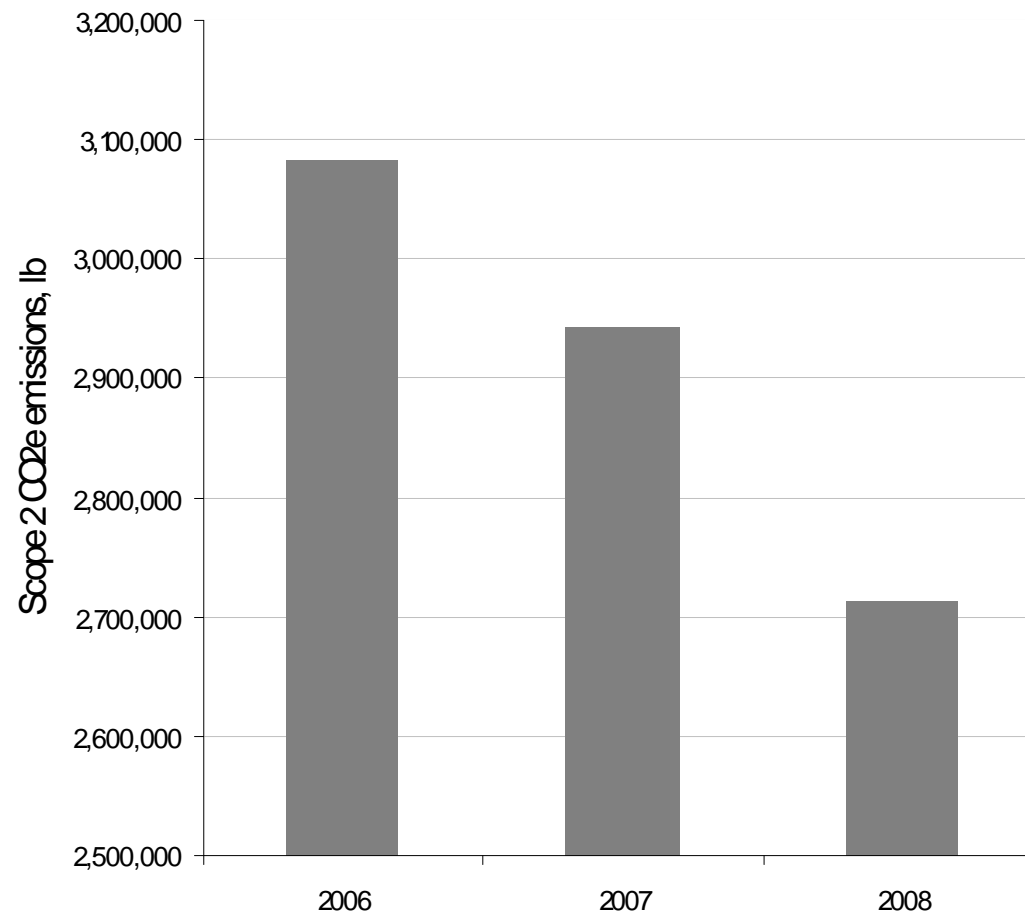
# RESULT: Operating costs are decreasing





# RESULT: Indirect CO<sub>2</sub> emissions from the generation of power purchased decreasing

Carbon Emissions, lb/Month for Blowers





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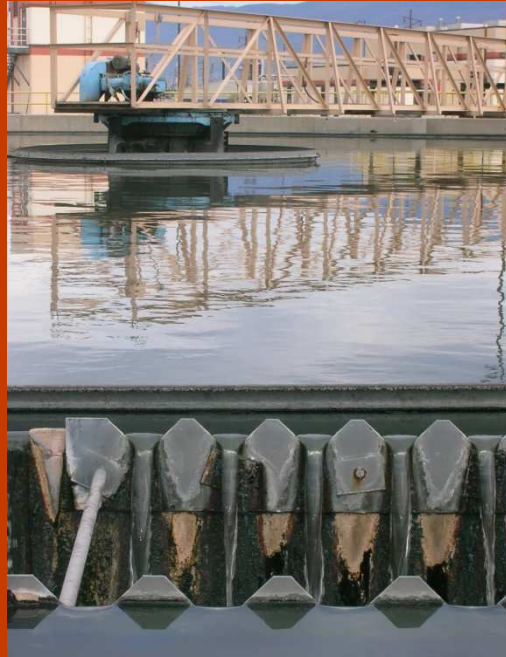
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**QUESTIONS?**

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