Chandler Fashion Center, Chandler, AZ

Start Date: August 16th, 2017

Address: 3111 W. Chandler Blvd, Chandler, AZ

Cooling Tower System: 3x BAC 1100-ton towers
UET Reactor Sizing: Three 4x4 UET Reactors

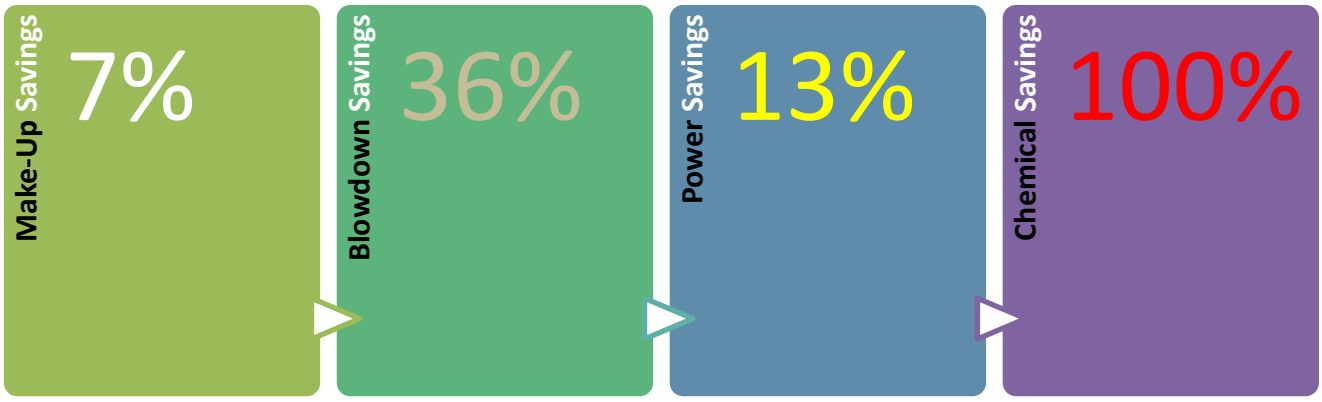
The Client:

Macerich, an S&P 500 company, is one of the country's leading owners, operators, and developers of major retail real estate. The company recently was awarded the National Association of Real Estate Investment Trusts' (NAREIT) 2017 Retail "Leader in the Light" for an unprecedented fourth straight year due to their sustainability goals – goals which Dynamic Water Technologies is a small part of.

This site is the second largest indoors mall owned by Macerich in Arizona. It houses over 200 outlets in 1.5 million square feet of prime retail space.

Savings (as of March 2018):

	Before UET (Aug 2016 – Mar 2017)	After UET (Aug 2017 – Mar 2018)
Cycles of Concentration (CoC)	3.64	5.26
Water Usage (gallons)	5,187,600	4,805,600
Sewer Usage / Blowdown (gallons)	1,426,000	913,600
Evaporation (gallons)	3,761,600	3,892,000



Accomplishments:

Chandler Fashion Mall was one of the first sites that Dynamic Water Technologies installed after the successful trial at Superstition Springs Center. There has been significant improvement in the sites' water and electricity consumption.

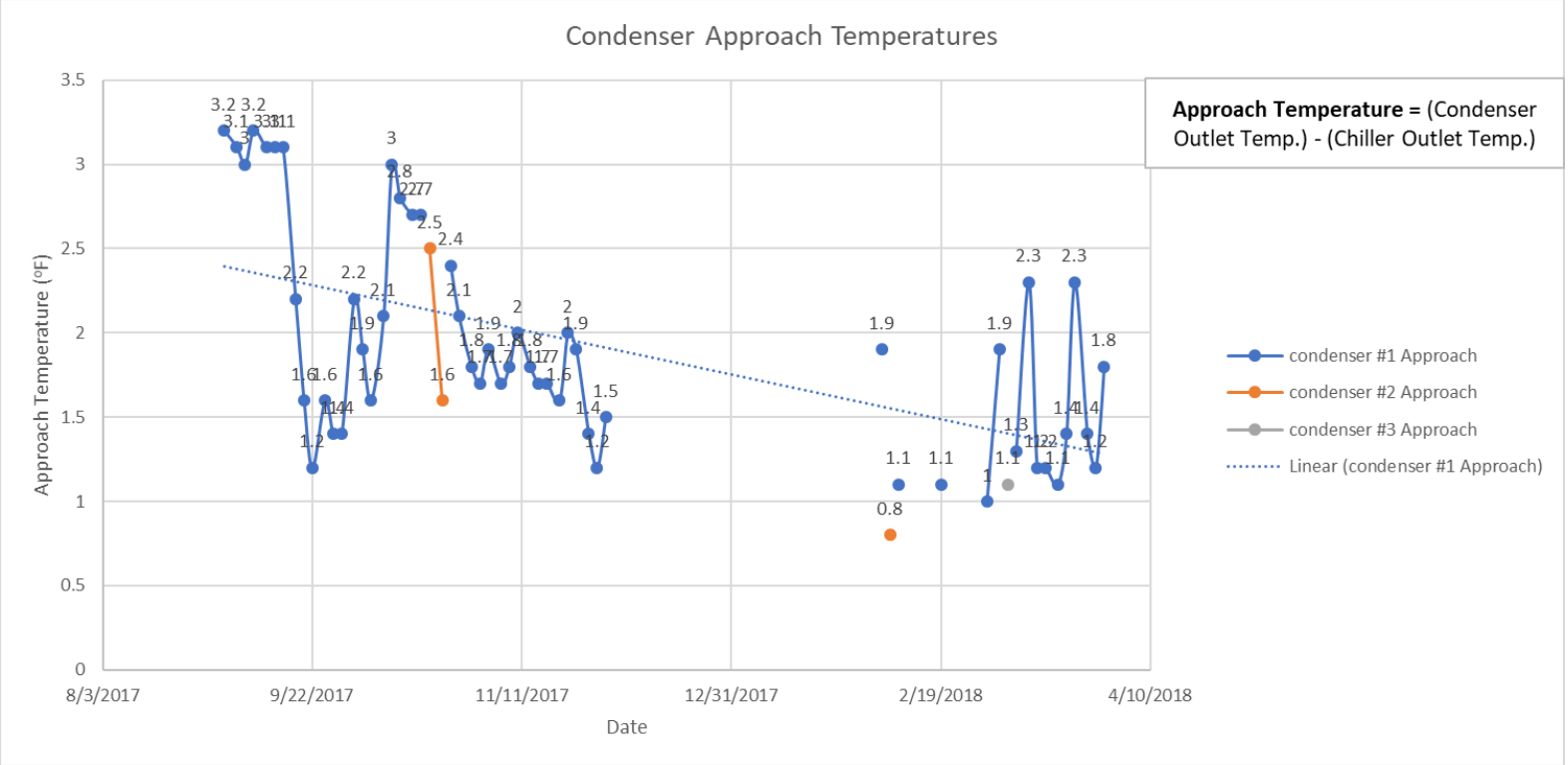
- Water savings - Cycles was increased from 3.64 (in 2016), to 4.38 (in 2017) using a 6,500 µS/cm setpoint and now to 5.26 (in 2018) using a 7,500 µS/cm blowdown setpoint – a value unachievable at this site through traditional chemical treatment.
  - Due to this the site has saved at least 512 thousand gallons of water since its start-up in August (in a period of 7 months).
  - This benefit was seen immediately, despite a heavier heat load in 2017 and 2018 (an extra 130,400 gallons of evaporation was needed). The raw savings is 7.0% in makeup and 36% in sewer.
  - Using 2017's heat load with 2016's CoC (prior to UET), the site needs an additional 130 thousand gallons of water to achieve enough evaporation. This translates to 10% savings in water and 38% savings in blowdown.

- Scale control - Scale began flaking off the tower rapidly and has continued to accumulate in the UET reactors. No new scale was evident in one of the chillers that was opened after 60 days of operation.

- Bio-contamination control – No algae bloom has been present in the basin at any time since start-up.

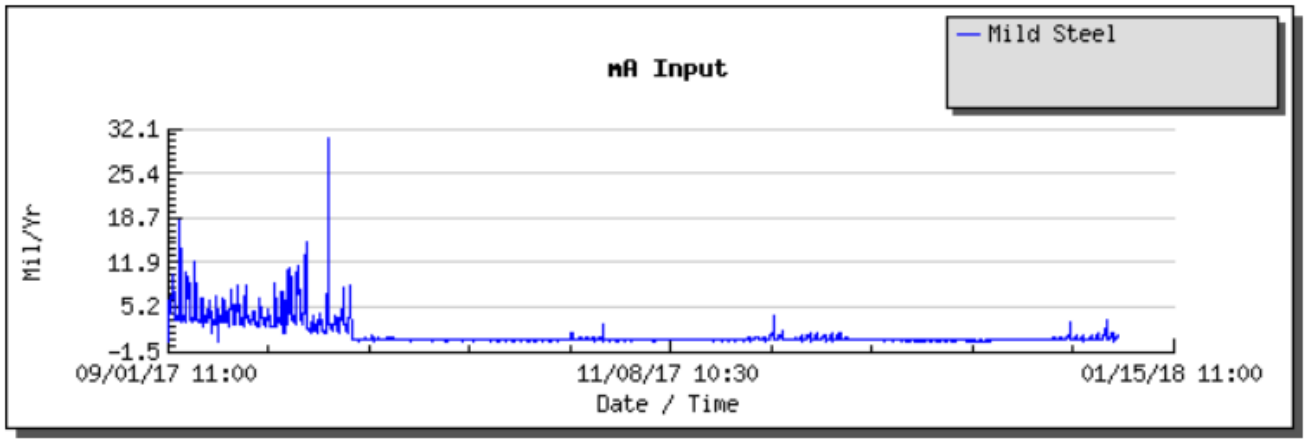
- Chemical savings - Chemicals were halted indefinitely at start-up.

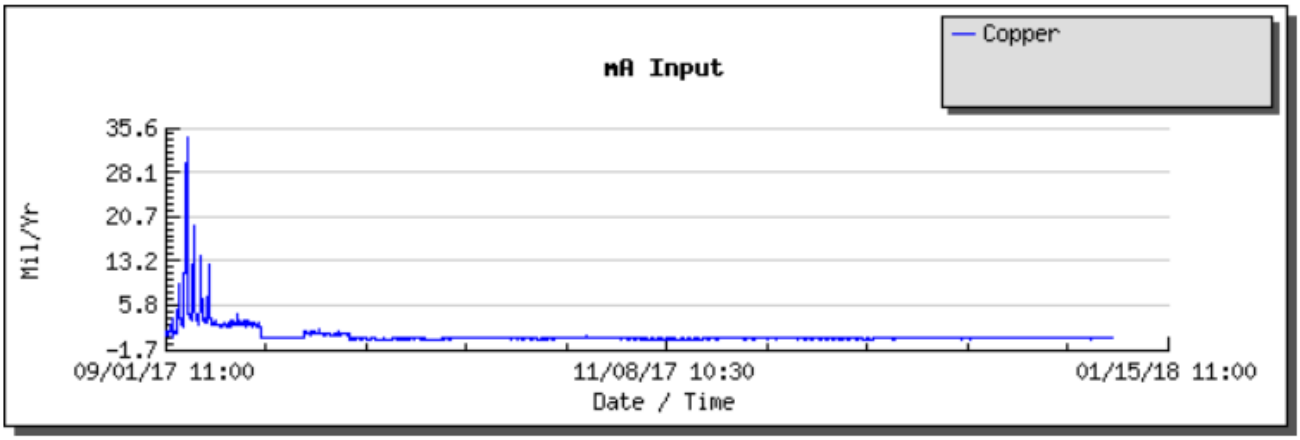
- Energy savings – the removal of scale is significant in improving energy efficiencies. Removal of historic scale is evident from the chemistry testing done by both Facility Engineers and DWT's Service Team.
  - The condenser approach temperatures have been the same, if not better since the start-up of the UET Reactor.
  - **Below: Graph of Approach temperatures at this site since September, 2017**



- Corrosion control - No signs of corrosion
  - Chemical tests showing 0.00 ppm iron in the water consistently.
  - This site has a LPR corrosion monitors (corrators) for both copper and mild steels that show corrosion levels below 0.20 mm/year for copper and 0.21 mm/year for mild steel.

Below: **Mild Steel and Copper Corrator data for first six months since start-up**





Right: **Signs of historic acid treatment & corrosion caused by acid spills before the installation of the UET reactors.**

Right: Tower Basin before UET (2/14/17):
Notice the green coloration in the basin. This shows probable presence of biologic growth prior to starting the UET water treatment systems. After three months of the treatment, little or no foaming was observed in the basin.

Left: Tower Fill and Basin Before UET (3/30/16):

Bottom: Tower Basin after 3 Month of UET (11/21/17):

<u>Below:</u> Fill of the cooling tower before the UET startup (3/30/16) and after 3 months of treatment (11/21/17)

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Water Information:

Make-up water quality for the City of Chandler (12/1/16 to 12/1/17)

PARAMETER	MINIMUM	MAXIMUM
Conductivity (µS)	610	1900
pH	7.89	7.46
Carbonate Hardness (ppm)	150	126
Total Hardness (ppm)	195	210
Iron (ppm)	0.00	0.00
Silica (ppm)	18	17
Chlorides (ppm)	46	363

Opening The UET:

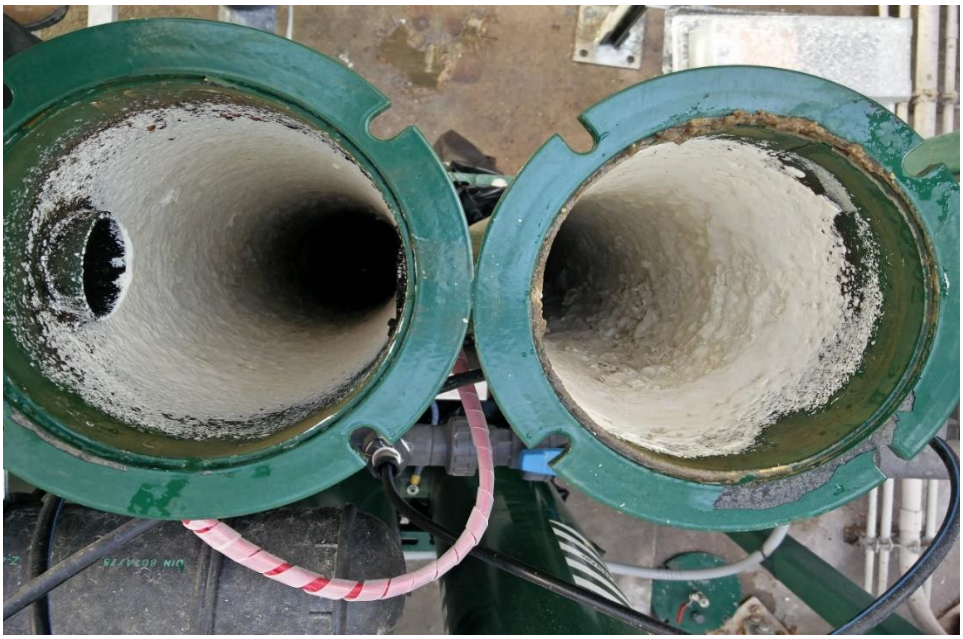
After three months of processing, DWT removed over 700 lbs of scale from the three reactors on this site. Images from 11/27/17 service.

During the six-month cleaning, DWT removed about 714 lbs of scale from the three reactors on site.

The scale was soft and white indicating that all or most of the historic scale has been removed within three months of operation.

The white scale seen here is built up calcium carbonate and magnesium carbonate, as well as silica and other heavy metals. The scale is then sloughed off using a long spatula, collected, and discarded. The scale is non-toxic, and can be discarded in general trash.

Bottom: Top view of two of the opened reactor tubes.



Opening the Condenser:

The chiller was opened to see the result two months after processing in October 2017 for routine winter maintenance. **No chemicals or heavy industrial equipment was used to clean the chiller tubes.**