



# Memorandum

**To:** CCBWQA Technical Advisory Committee and Destratification Sub-committee  
**From:** James R. Swanson, PE- JRS Engineering Consultant, LLC, William P. Ruzzo, PE, LLC  
**Date:** March 18, 2014  
**Subject:** Destratification System Compressor Start-up Procedure

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Presented in the memorandum is a summary of the Authority's destratification system compressor start-up procedure, discussion of prior years practice, review and discussion of the water quality data from prior year's operation and resulting start-up procedure modifications to optimize water quality conditions and system operating efficiency.

## **Background:**

The destratification system consists of a rotary screw air compressor, piping and 116 air diffusers placed at the floor of the deepest part of the reservoir. The system works by pumping air into the bottom of the reservoir providing mixing and oxygenation of the water. The Authority began operation of the destratification system on April 4, 2008. Prior to initial start-up in 2008, it was determined the aeration system would be operated for as long of a season as practical, typically from approximately March 1<sup>st</sup> through the end of November<sup>1</sup>. In doing so, continued water quality data monitoring developed a consistent baseline from which to evaluate, and predict, the benefits of operating the aeration system and to manage various water quality parameters within the reservoir. Specific start-up and shut-down dates were previously determined annually based on the Reservoir water quality data, weather patterns, ice cover and other factors.

It was found the destratification system needed to operate for approximately two weeks to attain full development of the water column circulation pattern, thereby reducing thermal stratification.

Data collected during this time period (2008 through 2013) indicates that the destratification system provides two primary benefits. One is the reduction in the dominance of blue-green algae as part of the whole algal assemblage and the second is the reduction in the periods when the reservoir is thermally stratified during the summer.<sup>2</sup>

## **Data Results and Trends:**

Water quality data collected from 2008 through 2013 suggests that operating the aeration system in early spring does not significantly affect blue-green algae (i.e.: cyanobacteria) growth, since the primary cyanobacteria growth period is from June through September when water temperatures are warmer<sup>3</sup>. A summary of this data is attached. Cyanobacteria are generally most active at temperature ranges above 15° C, which makes them most active in the summer months. This trend is supported by comparing chlorophyll a concentrations for pre and post-aeration system conditions, as shown in the attached data. Also, the daily maximum ambient temperatures near the reservoir are generally below 15° C from October through April (see attached data) providing further support for a later season system start date.

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<sup>1</sup> March 1 is the start of the boating season. Allowing boater access to the Reservoir before March 1 required Parks to have their safety and ANS (Aquatic Nuisance Species, such as Quagga and Zebra mussels) inspection personnel in place sooner, which potentially created an administrative problem. Starting the system before March 1 could clear the ice cover on the Reservoir and allow boaters to launch before Parks was ready.

<sup>2</sup> CCBWQA January 28, 2013. *Compressor Design Basis - Daily Operation*, William P. Ruzzo, P.E., Craig Wolf, GEI.

<sup>3</sup> GEI, Consultants, Inc. January 2014. *Cherry Creek Reservoir 2013 Water Year Aquatic Biological Nutrient Monitoring Study and Cottonwood Creek Pollutant Reduction Facilities Monitoring*.

The aeration system additionally provides destratification of the reservoir reducing the tendency for the reservoir to "turn over" bringing up anoxic water and higher concentrations of nutrients from the reservoir floor. The data from 2008 through 2013 suggests that the reservoir begins to stratify in late-April to mid-May. This varies from year-to-year, typically caused by an influx of snowmelt in the early spring and/or cold rainfall in the warm summer months causing temperature stratifications. It is noted that the aeration system is effective in minimizing stratification within the reservoir.

**Conclusions:**

1. The aeration system should be operational on, or about, May 15<sup>th</sup> to minimize the dominance of the blue-green algae (cyanobacteria) growth in the reservoir.
2. The aeration system should be started on, or about, May 1<sup>st</sup> to provide a fully developed water column circulation pattern by mid-May.
3. Operation of the destratification system beyond mid-November isn't supported by ambient temperature or algal population data for cyanobacteria or diatoms.

In summary, operation of the destratification system shall be modified as follows:

- a. System start-up shall occur between the dates of May 1<sup>st</sup> and May 10<sup>th</sup>.
- b. System shut-down shall occur between the dates of November 1<sup>st</sup> and November 15<sup>th</sup>.