

HW HAWKINS WEIR ENGINEERS, INC.

Engineering Client Success

January 28, 2019

Ms. Bailey Taylor, Enforcement Analyst
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317

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Re: NPDES Permit Number: AR0036692, AFIN-57-00423
Corrective Action Plan Milestone: Algae Bloom Mitigation Analysis
HWEI Project No. 2018149

Dear Ms. Taylor:

Hawkins-Weir Engineers, Inc. has been retained by the Mena Water Utilities to address the majority of the requirements of their Corrective Action Plan (CAP), dated November 17, 2018, and prepare a Long-Range Wastewater Treatment Masterplan. The CAP required that an Algae Bloom Mitigation Analysis be submitted by January 31, 2019. Please find that analysis enclosed.

Respectfully Submitted,

HAWKINS-WEIR ENGINEERS, INC.



Aaron M. Benzing, P.E.

AMB/hcd

Enclosure: One (1) Copy Algae Bloom Mitigation Analysis

cc: Honorable Seth Smith, City of Mena, AR Mayor
Mr. Charles Pitman, Mena Water Utilities General Manager

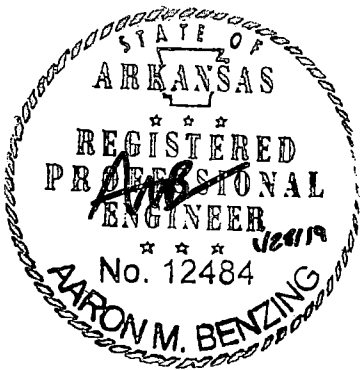
ALGAE BLOOM MITIGATION ANALYSIS

MENA WASTEWATER TREATMENT PLANT

FOR

**CITY OF MENA
MENA, ARKANSAS**

HWEI PROJECT No. 2018149



JANUARY 2019

PREPARED BY:



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Algae Bloom Mitigation Analysis

Background

This analysis has been prepared on behalf of the City of Mena by Hawkins-Weir Engineers, Inc. (HW) as a requirement of the Corrective Action Plan (CAP) submitted to the Arkansas Department of Environmental Quality (ADEQ) in fulfillment of the Consent Administrative Order (CAO) LIS 18-046. This aspect of the CAP is intended to analyze and address the effect of algae blooms in Lagoon #2 on the effluent of the wastewater treatment plant (WWTP).

Introduction

Algae is commonly seen as a nuisance throughout the water cycle. Excessive growth of algae is a common sign of eutrophication, enrichment of an environment with inorganic substances such as nitrogen and phosphorus. These algae can hinder aquatic life, cause objectional odors, and reduce the quality of surface waters in general. However, from a wastewater treatment perspective, algae are essential for the proper function of a treatment lagoon. Algae are autotrophic organisms that uptake inorganic nutrients (such as nitrogen and phosphorus) and fix carbon dioxide to grow in the presence of sunlight. A major byproduct of this metabolic process is the production of oxygen. This oxygen supports the continued growth of lagoon bacteria. In turn, the bacteria break down complex organic and inorganic substances into the micronutrients required by algae organisms. This symbiotic relationship is vital to the effective operation of a wastewater treatment lagoon.

Left uncontrolled, algae can also have a negative impact on National Pollution Discharge Elimination System (NPDES) permit holders' ability to treat wastewater within the permit limits. The formation of algal biomass can lead to an increase in the total suspended solids (TSS) concentration of the treatment lagoons effluent. Although different from the TSS present in the influent, the turbidity is still a monitored effluent characteristic that must be controlled. Another indirect compliance issue caused by algae is biochemical oxygen demand (BOD). For every 1 mg/l of TSS from algae, the effluent's BOD₅ is increased by approximately 0.5 mg/l.

Mena Wastewater Treatment Plant Effluent Quality

To determine the potential effect of algae blooms on effluent quality at the Mena Wastewater Treatment Plant, TSS and BOD₅ concentrations for the past three years were analyzed. The results of this analysis are presented in Figure 1. As shown in presented data, the Mena WWTP only had four (4) permit violations within the last three years with regards to TSS and BOD, all of which were for total suspended solids. While no violations of the NPDES permit are acceptable, TSS violations from lagoon systems are not uncommon. Each of the violations occurred in cold weather months which is outside of the time period where algae blooms are typically expected. We believe the cause of the violations was abnormally high influent flows. The high flows overload the effluent filtration system, reducing its efficacy and leading to increased TSS concentrations. The data presented in Figure 1 supports this assertion. All of the reported violations are accompanied by a high peak day flow and each occurred in months where average flow rates were high.

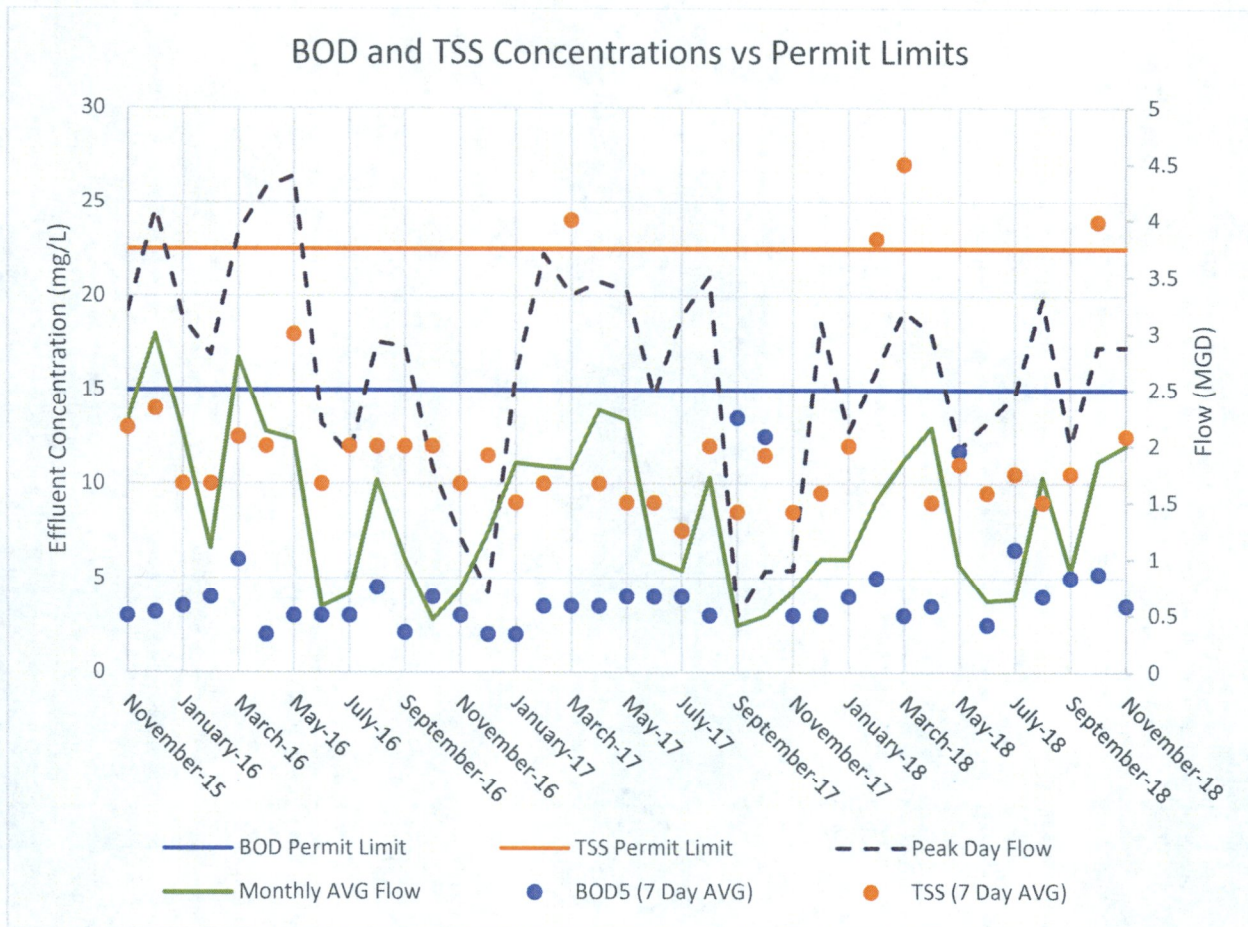


Figure 1: Effluent Characteristics for Mena WWTP

Algae Bloom Mitigation

The most commonly employed technique to prevent the growth of algae in wastewater treatment ponds is floating covers. These covers block sunlight, thereby inhibiting the growth of photosynthetic organisms such as algae. While these covers can help reduce the effluent TSS, they also eliminate the benefits of algae, such as nutrient fixing and oxidation. Typical costs for these systems range from \$2 – \$4 dollars per square foot. Therefore, the expected cost to cover the entire 33-acre Lagoon #2 would range in cost between \$2.9 million and \$5.9 million. It is anticipated that the WWTP’s diffused aeration system would also need to be expanded to account for the loss of the algae’s oxygen contribution. Alternatively, an area approximately equal to the last 5 acres of the system could be covered to stunt algae production and allow settling of dead algae cells. This alternative would leave an exposed edge across the width of the lagoon that would be difficult to secure from wind action. The cost for a partial cover is estimated to be approximately \$1 million.

Another common technique to control algae growth is the addition of chelated copper as an algaecide. Although effective, the Mena WWTP NPDES permit has a stringent limit on copper due to the impaired status of the discharge stream. Therefore, chelated copper is not recommended for algae mitigation.

It is important to consider the wastewater treatment process as a whole when evaluating algae mitigation improvements. Lagoon #2 currently discharges into a series of sand filters, the primary

function of which is to remove any remaining solids from the effluent. In this case, algae are the primary solids present within the effluent. The fact that the WWTP does not consistently violate its TSS permit limit and maintains perfect compliance during algae growth seasons supports the conclusion that the filters are effective.

Recommendation

In addition to this analysis, Hawkins-Weir Engineers is preparing a long-range plan for the City of Mena that will evaluate the following:

- Improvements necessary for the current WWTP to achieve consistent compliance
- Replacement of WWTP with new WWTP on the same site
- Replacement of WWTP with new WWTP on alternate site

The long-range plan is scheduled to be completed by June of 2019 and will consider, if required, any additional improvements needed for the City of Mena to address algae blooms. The City of Mena understands that capital improvements are needed to their WWTP to achieve consistent compliance. The long-range plan will help Mena identify the most cost-effective approach to address the underlying problems in their treatment system rather than seeking to address each individual symptom. It is likely that the long-range plan will recommend the construction of a new activated sludge treatment process. If this is the ultimate recommendation and if that recommendation is accepted and implemented by Mena, any money invested in the existing lagoon system would be lost. Therefore, Hawkins-Weir Engineers recommends that no algae mitigation improvements be made to the current WWTP until the long-range plan is complete.