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MEMORANDUM

To:	Mr. Charles Pittman
From:	Adrian J. Kaufman, P.E.
Re:	Mena Water Utilities Wastewater Treatment Plant Lagoon Levee Analysis
HWEI Project No:	2018149
Date:	August 29, 2019

STATE OF ARKANSAS LICENSED PROFESSIONAL ENGINEER No. 15655 8/29/19 ADRIAN J. KAUFMAN

Adrian J. Kaufman, P.E.
Hawkins-Weir Engineers, Inc.
Arkansas License No. 15655

CERTIFICATE OF AUTHORIZATION HAWKINS-WEIR ENGINEERS, INC. No. 101 ARKANSAS-ENGINEER

Certification of Authorization
Hawkins-Weir Engineers, Inc.
No. 101

Dear Charles,

As part of the City of Mena's Modified Corrective Action Plan (CAO LIS 18-046), Hawkins-Weir Engineers performed an investigation to evaluate the integrity of the lagoon levees at the City's Wastewater Treatment Plant. This memorandum summarizes the finding of our investigation and provides our recommendations along with an estimate of probable construction costs for the proposed levee improvements. Updated costs are also provided for the Project Alternatives identified in the Mena Water Utilities Wastewater Treatment Plant Master Plan dated August 2019. These updated costs incorporate the recommendations included in this lagoon levee analysis.

Background

The City of Mena entered into Consent Administrative Order (CAO LIS 18-046) with the Arkansas Department of Environmental Quality (ADEQ) to address sanitary sewer overflows, repeated discharge from an unpermitted outfall, and exceedances of permitted values for Total Suspended Solids and Ammonia Nitrogen. As part of the CAO, a Corrective Action Plan (CAP) and subsequent Wastewater Treatment Plant (WWTP) Master Plan were submitted to the ADEQ. Identified separately in the CAP were several areas of what was believed to be excessive moisture on the back slopes of the WWTP lagoon levees. The purpose of this evaluation is to investigate the condition of the existing levees and provide recommendations for any proposed levee improvements.

Site Investigation

The City of Mena utilizes an aerated lagoon system to treat their wastewater prior to discharge into a tributary of the Ouachita River. The lagoons were originally constructed in 1970 and no known record drawings exist for the earthen levees. As a result, all data and information required for this evaluation was obtained from field measurements, interviews with WWTP staff, and subsurface investigations. Both lagoons are approximately 6-feet deep and the levees have an approximate back slope height ranging from 2-feet to 20-feet. The bottom of each lagoon is believed to be flat and constructed of earthen material similar to the levees. During the site inspection, the areas of excess moisture were photographed and are presented in Figures 1 and 2. Additionally, during the site inspection, the water level within the lagoons was noted to be within 6-inches of the top of the levee. This operating level does not conform to the minimum 2-feet freeboard level recommended by the Ten State Standards for lagoon treatment systems.

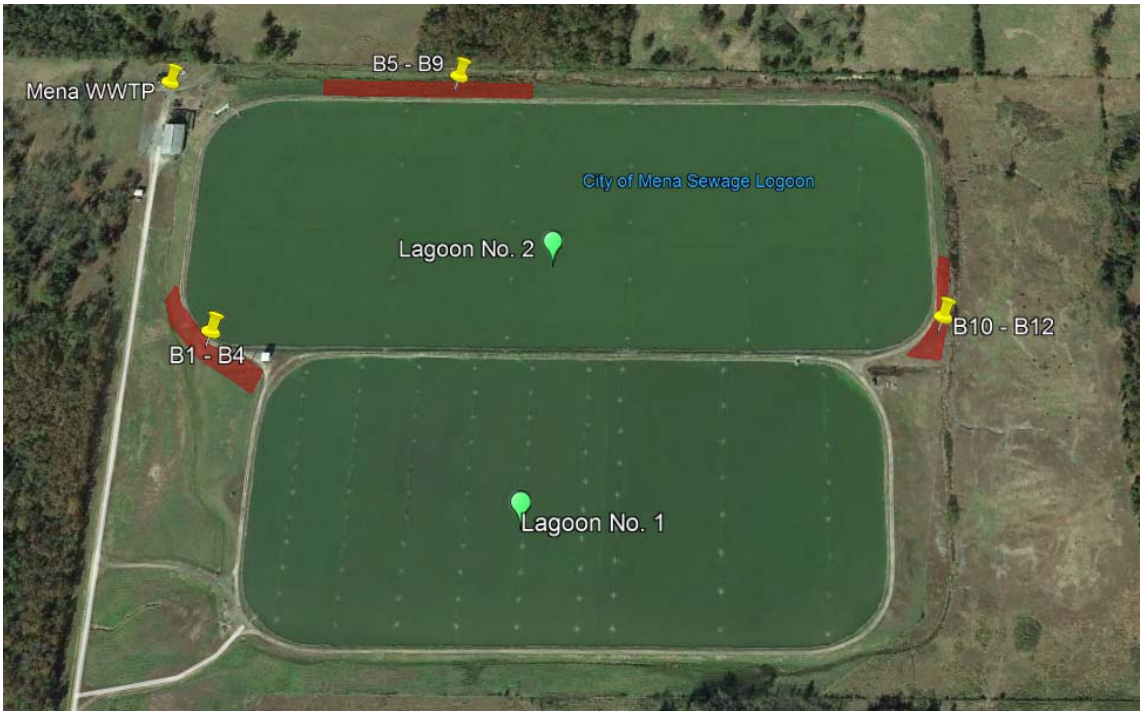
Figure 1: Excess moisture between Lagoon No. 1 and No. 2

Figure 2: Excessive moisture on north slope of Lagoon No. 2

Subsurface Exploration

Twelve (12) separate locations around the levees were selected to perform subsurface explorations through soil borings. For comparison of the levee composition, seven (7) locations within the areas identified with excess moisture and five (5) locations outside of the areas of excess moisture were selected. Figure 3 presents the areas identified with excess moisture and approximate boring locations. Soil borings were completed to a depth of approximately 20-feet, or until rock was encountered. Soil samples were taken every 2 to 5-feet for analysis of various engineering properties including plasticity, moisture content, Atterberg Limits, and soil classification. Additional information such as number of blows per increment and standard penetration values were also logged.

Figure 3: Approximate Boring Locations



Note : Areas identified with excess moisture are highlighted in red.

Summary of Findings

The subsurface investigations revealed two (2) major stratums of soil present within the lagoon levees: existing fill material consisting of lean clays with varying amounts of sand and gravel, silty clays, and gravel; and shale. In general, the fill material extended from the ground elevation to the layer of shale present at depths between 8-feet and 18-feet. Evident from the soil borings is the lack of an impervious soil or membrane layer within the levees. Modern levees are built with cores made of impervious materials to prevent seepage through the levee as required by the Ten States Standards. Although the fill material exhibited some plasticity, the presence of gravel, silt, and shale fragments ultimately interferes with the impermeability of the existing clay.

In addition to the permeability concerns, the blow per 6-inch increment counts for the fill material were low. This indicates little to no compressive strength within the levees themselves. Based on the information presented within the subsurface investigation, it is believed that the levees were constructed out of in-situ materials with little compactive effort made during construction. Groundwater was encountered in all of the soil borings, ranging from 1-foot to 13-feet below the ground surface. Although it is unknown if the cause of groundwater was related to seepage from the levees or naturally occurring groundwater, water present within levees is less than ideal and generally indicates a flaw in the construction of the impermeable layer or the dewatering system. Based on the findings presented above, extensive remediation measures would be required prior to utilizing both Lagoon No. 1 and No. 2 within the Project Alternatives identified in the Mena Water Utilities Wastewater Treatment Plant Master Plan dated August 2019.

Recommendations

Regardless of the selected project alternative, the lagoon levees will require remediation to prevent further seepage. To provide sufficient operational freeboard, the top elevation of the levees should also be raised. In addition to extending the life of the lagoons, these improvements would bring the levees into compliance with the Ten States Standards. To bring the existing levees into compliance, we would recommend that an impervious liner be constructed on the interior of both Lagoon No. 1 and No. 2. This impervious liner would be constructed of clay material imported from an off-site location. The fill material would be placed and compacted in lifts to ensure an impervious layer was established. This remediation would also include raising the top elevation of the existing levees approximately 1-foot to achieve the minimum free board requirements of the Ten State Standards. A new 6-inch layer of Class 7 gravel would be included on top of the rehabilitated levees to reestablish an access drive. To protect the interior of the levees from erosion and to eliminate ongoing maintenance requirements within the lagoons, it would be recommended that rip rap be placed along the interior slope of the levees. A typical cross-section of the recommended improvements to the lagoon levees is shown in an exhibit attached to the back of this technical memorandum.

Construction of the proposed levee improvements would require careful sequencing to ensure the wastewater treatment needs of the City of Mena were met throughout the construction process. Placement of the proposed fill material would require the lagoons to be completely drained and dried. Additionally, the sludge within the lagoons, particularly Lagoon No. 1, would need to be removed prior to construction. For Project Alternative No. 2 presented in the Master Plan, in which the lagoons are replaced as the primary treatment system and utilized as an equalization storage basin and a sludge holding pond, construction of the levee improvements would be phased after the new WWTP is placed into service. For project Alternative No. 1 presented in the Master Plan, in which the existing lagoon system treatment process is to remain, the lagoon levee improvements would be sequenced to be constructed following sludge removal with one basin out of service at a time.

Preliminary Cost Estimate

Table 1 presents a preliminary cost estimate for the improvements presented within this memorandum. This estimate includes cost provisions for Contractor's overhead and profit, engineering services, administrative and legal expenses, construction administration and inspection, and 20% contingency. A cost breakdown is provided for sludge removal and lagoon levee remediation, as sludge removal is already incorporated into the Project Alternative No. 1 costs presented in the Master Plan.

Table 1: Lagoon Remediation Cost Estimate

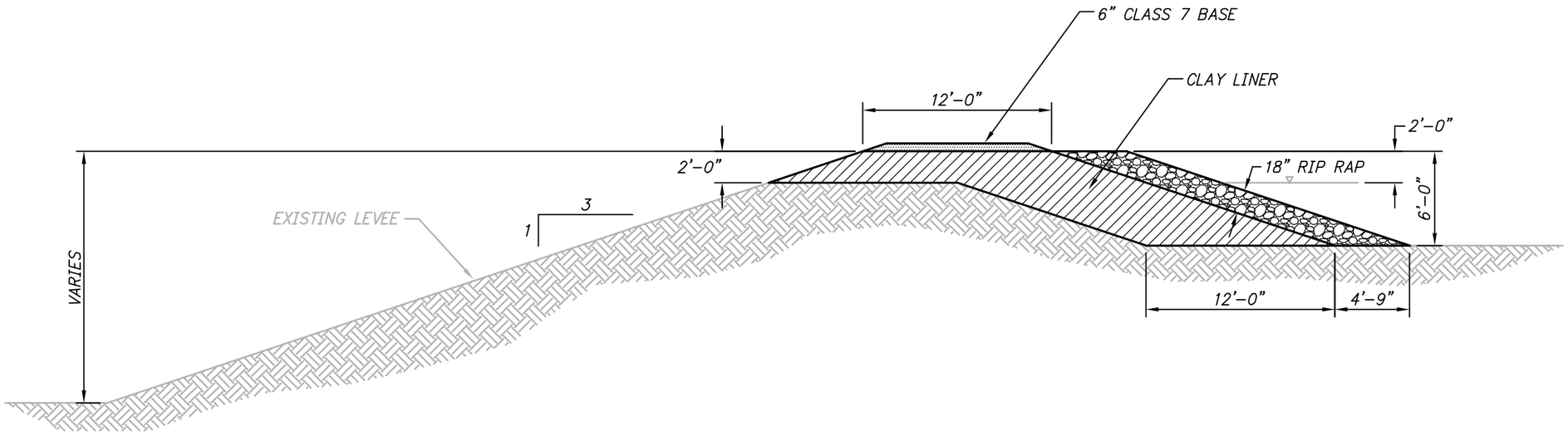
	Total Project Cost
Sludge Removal	$6,750,000.00
Lagoon Remediation	$2,320,000.00

Conclusion

The City of Mena's WWTP lagoon levees will require extensive remediation prior to being considered viable for use within Project Alternative No. 1 or No. 2 presented in the Master Plan. These remediation measures would include the construction of an impervious liner to prevent seepage, increasing the top elevations to comply with Ten States Standards, and reconstruction of the access drives around the lagoons. Updated total project cost estimates are included in Table 2 below for the Project Alternatives identified in the Master Plan.

Table 2: Revised Total Project Cost Estimates

	Revised Total Project Cost
Project Alternative No. 1	$16,170,000.00
Project Alternative No. 2	$17,570,000.00
Project Alternative No. 3	$10,750,000.00



LEVEE

SECTION

1/8"=1'-0"

MENA WWTP LEVEE		
FOR: MENA WATER UTILITIES		
AUGUST 2019	SCALE: 1/8"=1'-0"	JOB NO. 2018149

HAWKINS WEIR ENGINEERS, INC.
Van Buren (479) 474-1227 | Fort Smith (479) 242-4685 | Fayetteville (479) 455-2206 | Little Rock (501) 374-4846
www.hawkins-weir.com