

**Hap Cremean Water Plant Sludge Lagoon Improvements Project 690331
Additional Services Performed Outside Original Scope of Work
ms consultants, inc.**

1. Dividing Part 3 Lagoon Embankment Modifications into Part 3 and 3A. Part 3 construction was to make improvements to Lagoon 1 and 2 at Hap Cremean Water Plant (HCWP). The project was separated into two construction project, Part 3 and Part 3A, to spread the construction cost across two years, 2009 and 2010. Part 3 will now be Lagoon 2 Embankment Modifications, and Part 3A will be Lagoon 1 Embankment Modifications. The contract drawings and specifications were separated into two separate projects. The projects will be approved by ODNR separately, and will have 2 bidding and construction phases.
2. A Letter of Map Revision (LOMR) was required to allow construction of the lagoon embankment modifications and continued operation of lagoon 1 and 2. A LOMR was prepared and subsequently approved by FEMA for the sludge lagoon area of HCWP. The LOMR was required to all continued operation of lagoon 1 and 2 at HCWP. The lagoons are filled with alum and lime sludge as a redundant system to the sludge pump station at HCWP. HCWP staff would no longer be able to utilize the lagoons without the LOMR because the lagoons were in the floodway. Lagoon embankment modifications also required the placement of fill into the existing floodway. The LOMR modified the floodway to actual existing conditions near HCWP for the Big Walnut River. The original FEMA mapping did not utilize original topography for the HCWP area. The LOMR approval was delayed as FEMA adjusted their policy regarding existing levees.
3. Delay in construction of Part 3 and Part 5 due to the LOMR.

Part 3 and Part 4 (now Part 5) were initially scheduled to be construction in 2006 and 2007. The LOMR required for construction, as well as the separation of Part 3 and Part 3A, the change of Part 4 to Part 5, caused delay of the project from the original scheduled construction to the current schedule of Part 3 in 2009, Part 3A in 2010, and Part 5 in 2011.
4. Modification of Part 4, Lagoon 3 Sludge Removal and Abandonment to Part 5, Lagoon 3 Lagoon Sludge Removal and Abandonment. Lagoon 3 final sludge removal and abandonment was delayed beyond the original estimate of construction of this project in 2007. This delay was required as the LOMR was approved by FEMA, as the Lagoon 1 and 2 projects were separated, and due to an emergency construction project to remove sludge from lagoon 3. Construction of lagoon 3 improvements will now take place during 2011.
5. Addition of Part 4, Lagoon 3 Sludge Removal. Lagoon 3 sludge removal was required as an emergency project to allow continued operation of lagoon 3 at HCWP. Lagoon 3 filled more quickly than originally anticipated due to problems with the sludge pump

station force main from HCWP to the McKinley Avenue quarry. Sludge was removed from the lagoon and transported to the McKinley Avenue quarry, providing a redundant system to the sludge force main. As a part of this project, an outlet structure in lagoon 1 was repaired to allow the use of lagoon 1 as an emergency backup to lagoon 3 and the sludge pump station and force main.

6. Evaluation of additional soil stabilization methods for problem soil conditions found within lagoon 1 and 2. Further soils investigation along the Big Walnut Creek embankment and within lagoon 1 and 2 required evaluation of special methods to construct the new exterior embankments to meet Ohio Department of Natural Resources (ODNR) approval for a Class 2 dam. Four options were evaluated to find the most cost effective manner to construct the new embankments. The methods included remove and replace the poor material, deep soil mixing, partial displacement with slurry wall, and reducing the size of lagoon 1. The selected and most cost effective option was selected, which was to reduce the size of lagoon 1, and to complete partial displacement of soil in lagoon 2.
7. Additional soil borings in lagoon 1 from moving the embankment wall further away from the existing embankment.

Additional soil borings were required to change the embankment location in lagoon 1 from near the existing embankment along Big Walnut Creek to a better soil material in lagoon 1. The movement of the embankment allowed a construction cost savings for the project of approximately \$1,000,000.

8. Additional test pits in lagoon 2 to better quantify the extent of poor soils in lagoon 2. Additional test pits were excavated and the soil classified for the exterior embankment location in lagoon 2. The test pits were required to better quantify the material required to construct the partial displacement method to stabilize the embankment.
9. Pumping operations to remove water from lagoon 1 to lagoon 2 to complete the additional borings. The requirement of additional borings in lagoon 1, required the removal of water that had enter lagoon 1 after removal of the lime sludge from lagoon 1. The water the filled lagoon 1 was from rainfall. A plan was developed to remove water from lagoon 1 to lagoon 2 and presented to City staff for approval.. Lagoon 1 does not have an active decant structure to remove any water that enters the lagoon. Pumps were installed, rented, and maintained to remove the water from lagoon 1 during a three week period.
10. CC plans for storm sewer to drain water between existing embankments. The release of the new Columbus Stormwater Manual in March 2006 changed the requirements of storm sewer construction. This change required the "CC" plans be developed to meet the requirements of the manual for the storm sewer that is being constructed between the existing embankments and the proposed exterior embankments.

11. ODNR permit fees. ODNR required permit fees for the approval of the exterior embankments as a Class 2 dam. These permit fees were not included in the original contract proposal.
12. Modifications to the toe drain to install a chimney drain. Modifications were made to the contract drawings, and options evaluated and presented to City staff to modify the original toe drain to include a chimney drain. The chimney drain in a filter diaphragm that was recently developed by FEMA to allow control and draining of seepage from the embankment. The City requested the change be evaluated as a result of the poor foundation soils encountered. Additional seepage analysis was performed and presented to City staff and ODNR to gain approval of the chimney drain. The chimney drain was discovered to be a very cost effective solution to provide an increase factor of safety for the embankments.