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Request for Proposals

Wastewater Options for the City of Las Vegas, Santa Barbara, Honduras

City of Las Vegas

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Master of Engineering Program

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Background

The city of Las Vegas is located on the NW corner of Lake Yojoa, and is the largest municipality on the lake. The city and lake are located in a mountain valley in an area of former volcanic activity between Honduras' two major cities, San Pedro Sula and Tegucigalpa. The lake is the only notable natural lake in Honduras, with a depth of greater than 50 feet and a surface area of over 90 km².

Las Vegas has a population of 18,000, less than 40% of which is connected to the sewer system. The wastewater that is collected flows by gravity through an open culvert system to a pair of Imhoff Tanks on the eastern side of the city.

Imhoff tanks provide a simple form of primary treatment that requires little maintenance. Inflow is directed through channels on the surface of the tank which serve as settling tanks, while sludge is collected and digested in bottom chambers (Beaumont, 1929; Tchobanoglous et al., 2003). Since flow is usually by gravity, no electricity is required making them attractive for remote areas. They were common in the first half of the 20th C and are still prevalent throughout the developing world, and particularly in Latin America.

The pair of tanks serving Las Vegas are undersized and, like many other tanks in Latin America, have fallen into disrepair. For example, there are missing control gates and sludge is not being removed. As a result, the effluent is barely treated (Herrera, 2006). The effluent discharges to nearby Raices Creek which later empties into Lake Yojoa. The Las Vegas effluent is one of many contributors to declining water quality in the lake (Chokshi and Trate, 2006).

Chemically Enhanced Primary Treatment

As his Masters thesis at the University of Texas, Herrera (2006) studied the Las Vegas tanks and made a number of recommendations regarding repair and improved maintenance. In addition to implementing his recommendations, an interesting option to improve tank performance is to add modest quantities of coagulants (e.g., FeCl_3) to the tank to promote sedimentation. So-called Chemically Enhanced Primary Treatment (CEPT) has been used at a number of sites in both rural and urban areas, providing either stand-alone treatment, or serving as an initial treatment stage prior to secondary treatment (Harleman and Murcott, 2001). It has also been central to several previous MEng projects at MIT.

CEPT has many advantages compared with conventional primary treatment:

- Because most of the increased solids removal, effluent can be more easily disinfected
- A settling tank can handle two to three times the overflow rate (ratio of influent flow rate to tank surface area)
- Under favorable conditions, the effluent can approach biological secondary treatment removal efficiencies for BOD and TSS
- Again, because of increased solids removal, high phosphorous removal is also possible

Other than the handling of coagulants, there is little additional maintenance required with CEPT, though it does produce additional sludge (primarily as a result of the higher treatment levels and not because of the chemicals themselves). CEPT effectiveness depends on influent quality, which usually requires that bench scale or pilot scale testing be conducted to establish effective coagulant dosage.

Proposed Study

We seek technical assistance in exploring options for improving the waste water treatment for Las Vegas, building on the earlier study of Herrera (2006). Potential areas of investigation include, but are not limited to:

- Removal efficiency of the existing tanks
- Options for sludge handling
- CEPT testing (bench and/or pilot scale)
- Conception design of a full scale system
- Identification of local sources of coagulants (e.g., FeCl_3)

In addition, we would be interested in learning more about the status (number, their location, and state of repair) of other Imhoff tanks in Latin America.

The work is anticipated to require 800 to 1600 hours of technical effort (2 to 4 MEng students), leading to a draft final report on Friday, April 11, 2008. Assuming a one-week review by the sponsor, a final report is due on Friday, May 9, 2008 (along with thesis). In addition, the successful team will be expected to make one or more oral presentations to the client and the public and to travel to the site for a three-week period in January 2008. The study will be supervised jointly by Dr. E. Adams and by A. Herrera (now working for Malcolm Pirnie in Austin, TX) who will accompany the MEng team during at least a portion of their trip in January.

Prospective bidders are asked to forward a letter of intent (LOI) with team qualifications to the above address by 5:00 pm, October 5, 2007. The LOI should be no longer than 2 pages, exclusive of resumes, and should outline the team's preliminary plans for the project. Bidders will be notified by October 12 if they have made the short list, and successful bidders will be asked to submit a full technical plus cost proposal by December 7, 2007.

Management, Personnel, Schedule and Budget

The full proposal should include a breakdown of responsibilities by staff member, including the name of a project manager; a schedule for completion including project milestones and progress reports; and details regarding cost, expressed in terms of hours of effort by job classification (staff engineer, project manager).

Basis for selection

The project will be evaluated on a competitive basis using the following criteria:

- does the proposal address the client's needs?
- originality
- likelihood of success
- cost (expressed in terms of people-hours)

References

Beaumont, H.M. (1929) The Operation of Imhoff Tanks, *Sewage Works Journal* 1(2).

Chokshi, M. and Trate, T. (2005) *Nutrient Load Analysis and Temperature Analysis for Lake Yojoa, Honduras*, MEng Project Report, Dept of Civil and Environmental Engineering, MIT.

Harleman, D. and Murcott, S. (2001) *An Innovative Approach to Urban Wastewater Treatment in the Developing World*. *Water 21: Magazine of the International Water Association*, June, 2001.

Herrera, A. (2006) *Rehabilitation of the Imhoff Tank Treatment Plant in Las Vegas, Santa Barbara, Honduras, Central America*, MS thesis, Dept of Civil, Architectural and Environmental Engineering, U. Texas, Austin.

Tchobanoglous, G., et al. (2003) *Wastewater Engineering: Treatment, Disposal and Reuse* 4th Ed. Metcalf & Eddy, Inc., McGraw-Hill, New York, NY.