

MEMORANDUM
LIFE-CYCLE COST ANALYSIS

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Comments:
Revised:
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Review: Tom Falk, P.E.
Subject: Life-Cycle Cost Analysis for Grit System

BACKGROUND

The City of Guadalupe owns and operates a 0.96 mgd wastewater treatment plant (WWTP). The City recently completed a plant upgrade that converted a poorly-performing pond system to an extended aeration, activated sludge system utilizing the Biolac® process. The existing WWTP includes a grit removal system that has been bypassed in recent years due to inoperable equipment. The grit system was installed in the early 1990's and consists of a vortex grit chamber, grit pump and grit classifier. The equipment has reached the end of its useful life. Furthermore, the technology utilized in vortex-style grit removal systems has improved significantly over the past two decades.

The proposed project elements will reduce anticipated long-term operational costs of the new plant and will improve plant performance including reliability in producing high-quality secondary effluent.

The City is pursuing grant funding through Proposition 84 to rehabilitate the inoperable grit system. This memorandum documents a life-cycle cost analysis completed to support the financial viability of the proposed upgrades.

LIFE-CYCLE COST ANALYSIS

A life-cycle cost analysis was performed, taking into account the major cost elements to compare the proposed project to a “no project” alternative. The cost analysis includes the following major considerations:

- Estimation of grit volume on annual basis using published figures in Metcalf & Eddy, “Wastewater Engineering, Treatment and Reuse” 4th Edition. The range provided in M&E (Table 5-19) reports average grit quantity between 0.53 to 5.0 cubic feet of grit per million gallons. An average grit quantity of 5.0 was selected for this analysis considering the age of Guadalupe’s collection system, the typical sandy soils in the service area, proximity to the beach, and the characteristic agricultural community.
- Assuming that without an operable grit system, the grit load to the plant will accumulate in the Biolac basin, we determined that a dredging/cleaning operation of the basin would be required on an average frequency of approximately 8 years at a current-year cost of approximately \$350,000 per occurrence. This value is based on competitive bid prices from the 2011 bid proposal from Spiess Construction (Low Bidder for the recently completed Guadalupe WWTP upgrade project) for cleaning AIPS ponds 1,2,4 (Alternative Bid Item 3 which wasn’t awarded) and a derived cost per CF for removal which incorporated a “complexity factor” to account for the challenge of working in a full basin, protecting the HDPE liner, and the washing/cleaning and hauling/disposal of grit material to a landfill.

- The dredging/cleaning operation would require a major diversion of wastewater treatment onsite, potentially to the abandoned AIPS ponds while the basin is accessed by a contractor. This mobilization, diversion, temporary treatment and restoration of normal plant operations are assumed to cost approximately \$180,000 per occurrence.
- The analysis did not include additional costs associated with reduced reactor volume and loss of treatment efficiency, additional wear on pumps and damage to diffuser equipment, and the additional cost of routine O&M attention to the plant to handle nuisance grit in the Biolac basin, clarifiers, and sludge equipment. These impacts are real but are difficult to quantify and are believed to be small relative to the cost impacts above. These costs are assumed to be generally offset by the annual operating costs of maintaining the grit removal system in the proposed project alternative.
- Time Value of Money was estimated to determine present worth value of project alternatives according to the following criteria:
 - Current project reference values used for estimating future expenditures were escalated by 3% annually reflecting a typical long-term construction cost trend (Note that the average annual construction cost increase according to Engineering News Record, ENR-CCI, between 1992 to 2012 is 3.14%);
 - Future costs were discounted by 6%, consistent with Department of Water Resources, Economic Analysis Guidebook (2008);
 - Life-Cycle Cost Analysis assumed a 20-year life cycle period.

CONCLUSION

Using these cost assumptions, a simple cost model was developed to evaluate the present worth value of the “no project” alternative for comparison to the proposed project cost. The 20-year present worth value of the “no project” alternative was approximately \$650k. In comparison, the Net Present Value of the proposed project is only \$600k. The Benefit-Cost Ratio is greater than 1.0. It is noted that the grit system, with proper maintenance and care should be expected to have useful life beyond 20-years.