MEMORANDUM

To:	District Leadership
From:	Ken Abraham
Date:	October 16, 2018
Subject:	CO Tanks – Conversion to Primary Effluent Equalization

This technical memorandum (TM) has been prepared to support the Business Case Evaluation finalized in September 2015 recommending the conversion of the carbonaceous oxygen (CO) tanks for use as diurnal primary effluent equalization once the biological nutrient removal system is in operation. The TM updates the proposed project with improvements already made and further additional non-economic factors based on current diurnal flow patterns.

Background

In 2012[1], nine alternative options were initially considered for the CO tanks after the BNR facility is in operation, ranging from incorporation of the tanks in the treatment train, emergency and off-peak storage, and conversion to gravity thickeners for primary sludge thickening. Additional options were then considered for the CO Tanks including storm water storage, waste activated sludge (WAS) storage and pre-thickening, filter backwash equalization, and diurnal flow equalization.

In late 2013 and early 2014, Regional San leadership began negotiating with the Central Valley Regional Water Quality Control Board (CVRWQCB) and other interested parties regarding the concept of a Seasonal Reduced Filtration Alternative. This culminated in an agreement to provide a maximum 217-million gallon per day (mgd) filtration facility with wet weather diversion of flows exceeding 217 mgd. During this negotiation period, CVRWQCB and Regional San Policy and Planning (P&P) Department requested that the Program Management Office (PMO) prepare a number of analyses dealing with alternative flow scenarios. The final analysis requested by CVRWQCB and P&P was to demonstrate the facilities required for processing diurnal flows expected in 2048. The results of the analysis indicated that the total primary effluent (PE) storage need is approximately 62 million gallons (MG) based on an up-scaled diurnal profile and 26 MG based on a smoothed diurnal profile[2]. At this time, Regional San determined that diurnal equalization would be provided in the CO tanks since the Emergency Storage Basins (ESBs) are open storage tanks and are not intended for regular daily use for diurnal flow storage. For instance the CVRWQCB Order R5-2016-0020 describes the purpose of ESB-A as “to store diverted

[1] Carbonaceous Oxygenation Tanks Repurposing Alternatives Business Case Evaluation – September 2012.
[2] SeasonalandReducedFiltrationProjects rev7 – January 2014.

influent flows above the hydraulic capacity (peak wet weather flows) of the Facility and to store diverted effluent flows to meet various conditions to comply with this Order".

Technical memoranda were also prepared in November 2014[3] to further evaluate options and in August 2015[4] to address return of Sump 404 flows.

The CO Tanks will become available for alternative uses after Battery II SSTs are converted to BNR treatment. This conversion is scheduled for approximately June to July 2020. After this conversion, the cryogenic oxygen facility and the CO Tanks will be shutdown.

Business Case Evaluation

A business case evaluation (BCE) was finalized in September 2015, with two options, 1) Full equalization requiring capacity upgrades for draining and pumping an instantaneous flow of up to 60 mgd, and 2) Partial equalization restricting return flows from the CO Tanks to a maximum of approximately 27 mgd based on the existing capacity of the pumps in Sump 404. The partial equalization option was recommended for economic reasons and this option provides an opportunity to phase additional improvements if necessary. As mentioned below, this option is further supported by water conservation.

Since 2015, some components of the project identified in the BCE for partial equalization have been installed for other reasons. In addition, design improvements have been recommended that reduce the capital cost for the partial equalization option. For example, the effluent valve replacement (EVR) project includes work to redirect the return from Sump 404 to the south PE channel, and the BNR/PEPS project designers have been requested to convert isolation walls in the North and South PE channels to weir walls that will eliminate the need to modify the inlet gates on all 12 existing CO tanks. Further, the BNR contractor is already contracted to plug the exit openings from the 8 South CO Tanks. Deleting these items from the cost estimate prepared in 2015 will reduce the estimated capital cost of the partial equalization project from $1,263,000 to less than $1,000,000.

Based on the lifecycle cost analysis, partial equalization provides a significant economic benefit. However as noted in the BCE, partial equalization is an interim solution and additional upgrades may eventually be required. If optimization studies prove the value of diurnal flow equalization, Regional San could then consider making additional improvements (i.e. repairing CO Tanks, installing new mixers, adding odor control facilities, upgrading Sump 404 pumps, etc.) to permanently convert the CO Tanks for diurnal flow equalization. The 2015 cost estimate for providing a biofilter for odor control, and new mixers in all CO tank compartments, was $9.9 million and the estimated cost for CO tank rehabilitation was $1.9 million per tank.

[3] CO Tank Conversion v2 Business Case Evaluation
[4] Sump 404 Modifications

Recent Findings

Recent water conservation efforts in the Sacramento Metro area has made diurnal equalization easier to accomplish. The average influent flow has decreased by approximately 20 mgd since the 2008-2011 design data period. Both diurnal hourly low flows and high flows have decreased, but high flows have decreased more than low flows as is seen in Figure 1. Therefore, the pump return capacity for the equalization system is reduced.

In addition, an unquantified economic benefit of the diurnal equalization system is improved operation of the filters. In Figure 2, the number of filters required to be in operation for an un-equalized system is 17 (blue line) to process diurnal peak flows at the design dry weather filter loading rate of 6.3 gpm/sq.ft, while only 12 (red line) are required if flows are equalized. Operating 17 filters during dry weather periods is not preferred because a) if filter backwash is on a time based schedule, filtration efficiency (measured as: (product water/(product plus backwash water) will be poor resulting in unnecessary flows through the PSTs and BNR processes, and b) if filter headloss is used as the criteria to trigger a backwash, there will be problems with excess biological growth on filter media, media compression, and mud balls (the Easterly WWTP at Vacaville experienced similar problems with too many filters on-line and infrequent backwashing).

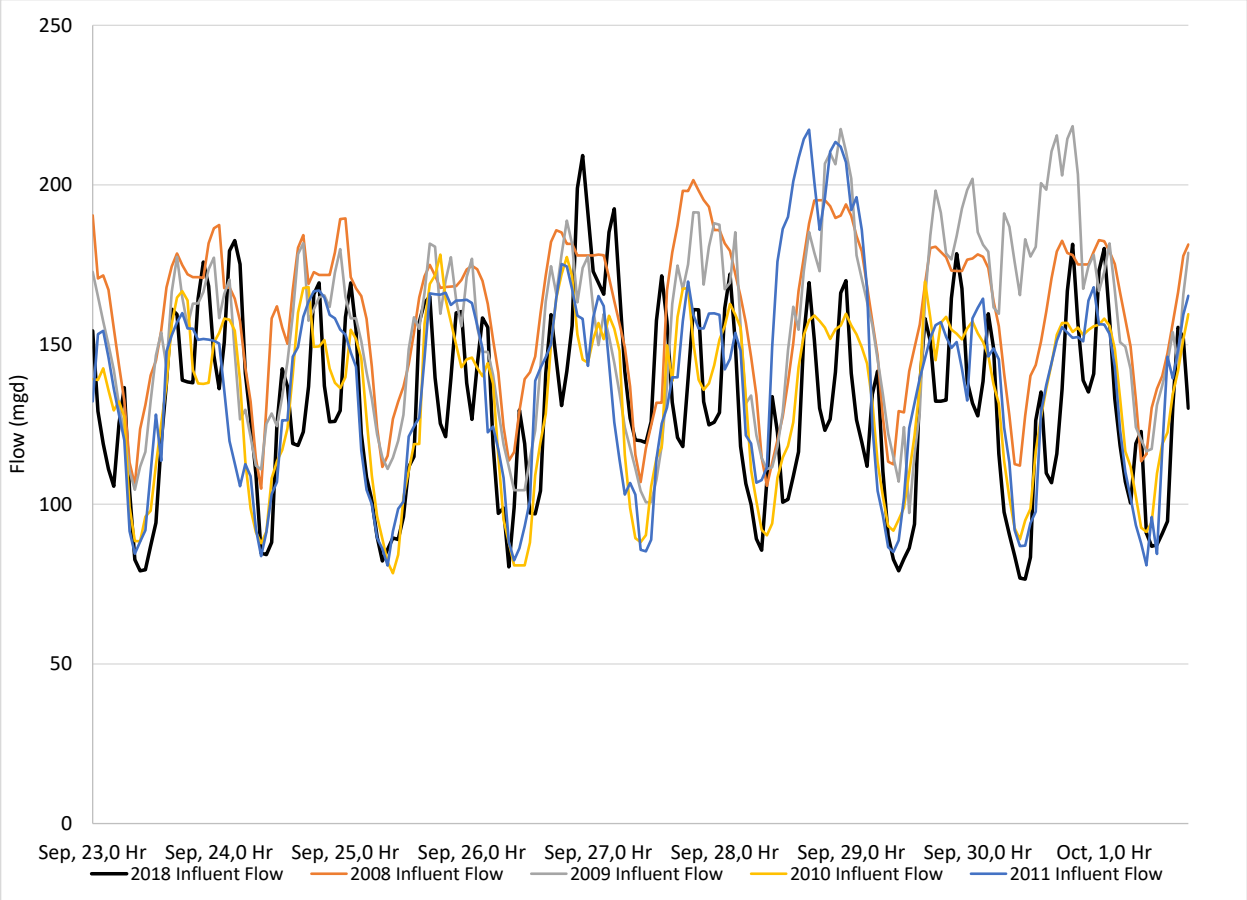

Figure 1: Comparing Diurnal Flows 2018 versus the Design Period of 2008 – 2011

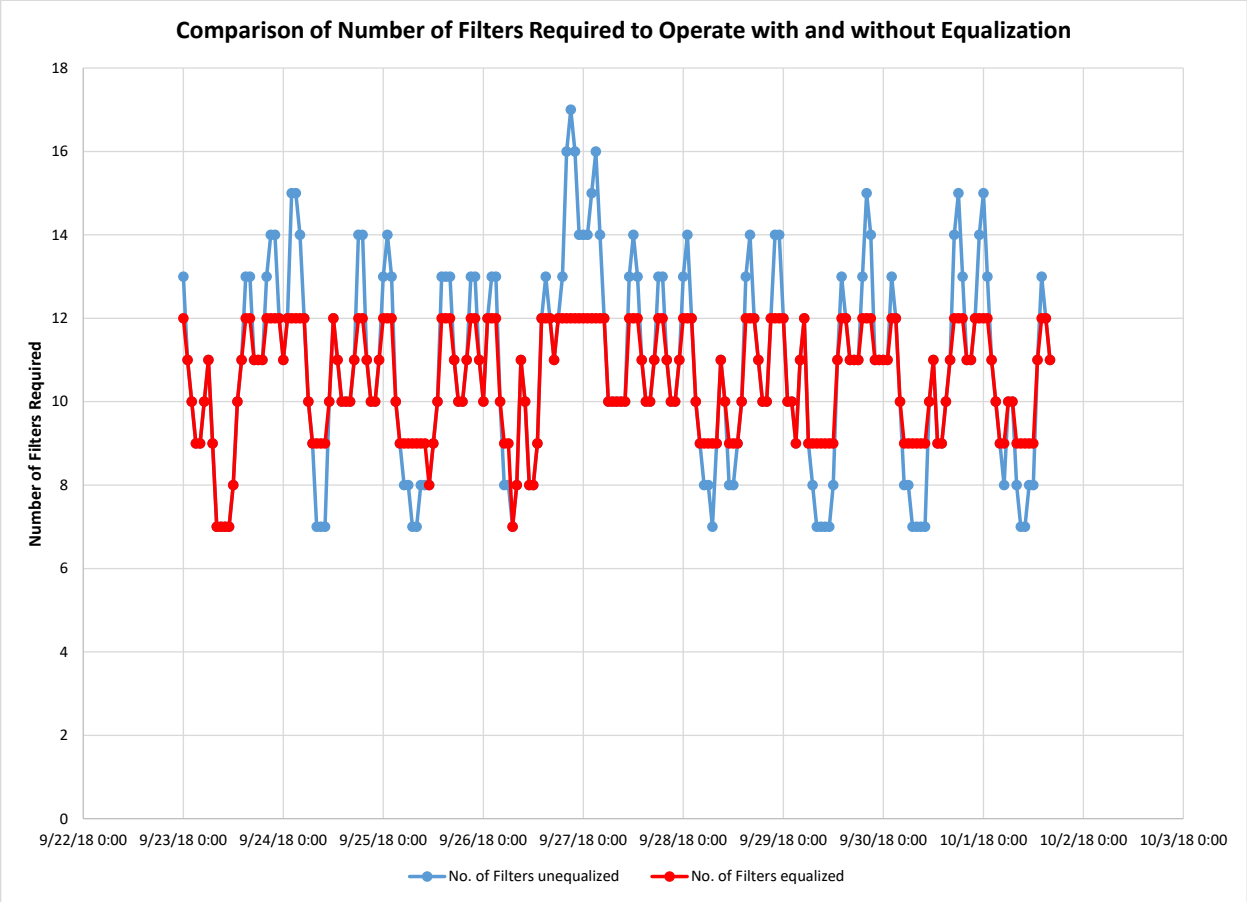

Figure 2: Number of Filters Required with and without Equalization