Technical Memorandum

TO: Chris Myers, PCC Structurals Inc.

FROM: Joseph Kalmar, PE

DATE: April 29, 2016

RE: **Stormwater Treatment System Design Summary**
PCC Structurals Inc. Large Parts Campus
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Introduction

This document has been prepared to provide a summary of the design of a stormwater treatment system for the PCC Structurals Inc. (PCC) Large Parts Campus (LPC), located at 4600 SE Harney Drive in Portland, Oregon, that will be installed to comply with the requirements of its National Pollutant Discharge Elimination System (NPDES) General Stormwater Discharge 1200-Z Permit (Permit) issued by the Oregon Department of Environmental Quality (ODEQ). In addition, the treatment system will support PCC's efforts to remove legacy pollutants from its stormwater discharges. Legacy pollutants are being addressed under Voluntary Cleanup Program (VCP) Agreement No. LQVC-NWR-08-05 between ODEQ and PCC.

The treatment system is a chitosan enhanced sand filtration (CESF) system. This type of coagulation and filtration system is a best available technology for removing total suspended solids (TSS) from stormwater, and removing all the other pollutants associated with those solids, including chromium, copper, nickel, zinc, and polychlorinated biphenyls (PCBs). The design of the filtration component of the CESF system has also been enhanced to add granular-activated carbon (GAC) for removal of residual volatile organic carbon compounds (VOCs) as well as dissolved metals.

Background

As per Schedule A.12 of the Permit, Landau Associates completed a 2nd year Geometric Mean Benchmark Evaluation. The evaluation identified that TSS, copper, and zinc exceeded benchmark values. Therefore, per Schedule 12.c.i of the Permit, a Tier II Corrective Action Response (Tier II CAR) was prepared and submitted to the Bureau of Environmental Services (BES). While ODEQ issues the Permit in Portland, the City (through BES), as an agent for ODEQ, handles certain Permit functions such as PCC's Tier II CARs. The Tier II CAR identified CESF as an effective stormwater treatment technology for achieving Permit benchmark values.

CESF is a well-developed stormwater treatment technology that is often employed at construction sites to reduce the amount of TSS and turbidity in stormwater. The Washington State Department of Ecology has given General Use Level Designation to a number of CESF devices or systems. CESF has also been approved for use at industrial facilities and specifically approved by the US Environmental Protection Agency (EPA) as the preferred treatment technology at an industrial facility for removal of TSS, PCBs, and other pollutants in facility stormwater.

The CESF treatment processes include the following elements: coarse solids settling in aboveground settling/storage tanks, solids coagulation via chitosan acetate dosage (less than one part per million [ppm] of chitosan acetate solution containing the natural biopolymer chitin), sand filtration through a bank of sand filter units to remove the coagulated solids, and automated sequential backflushing of the sand filter units to maintain system treatment capacity and associated TSS and other pollutant removal efficiency. A system of this type was installed at a site in Seattle, Washington, primarily to control discharge of PCBs. Ongoing system operation has demonstrated removal of PCBs to concentrations below detection levels using EPA Method 8082 and removal of particulate metals by removing TSS. The CESF system removes metals associated with particulates but is less effective with removal of metals that are in dissolved form. As described below, GAC will be included in the filter vessels to remove VOCs and dissolved metals. Additionally, polyaluminum chloride, a coagulant that will enhance removal of dissolved metals, can be dosed along with the chitosan acetate.

Chitosan Enhanced Sand Filtration System Design

The main components of the CESF system for the LPC are an inlet weir/settling tank and a backwash solids settling tank (each approximately 21,000-gallon capacity), three storage tanks (each approximately 21,000-gallon capacity), three sand filter systems each consisting of four individual 54-inch-diameter sand filter vessels, and a control system housed within a 40-foot container. The three independent sand filter systems would each treat a design flow rate of 500 gallons per minute (gpm), for a combined capacity of 1,500 gpm. The extra capacity greater than the 1,110-gpm design flow rate would conservatively provide for some re-treatment of treated stormwater that does not meet the turbidity set point.[1] The extra capacity would also accommodate potential ongoing groundwater infiltration into leaky storm drain piping that cannot be repaired due to its location under the plant. The purpose of three independent sand filter systems is to allow portions of the treatment system to operate more continuously during low-flow conditions, to keep the size of the system components to within a range that avoids larger special-order equipment, to allow more flexibility in maintenance (with the capability to take one of the systems off-line for periodic maintenance), and to allow for potential downsizing of the system in the future.

[1] Turbidity is an indicator of suspended solids concentration.

Given the available filtration surface area of approximately 64 square feet (ft^2) for a four-vessel sand filter unit, a 500-gpm flow results in a sand filter loading of approximately 7.9 gpm/ft^2. This design loading is well within a typical sand filter design loading of 15 gpm/ft^2, and that general use designation is for construction stormwater projects with much higher TSS loading compared to the LPC facility. Even during backflush cycles (under higher back-pressure and reduced flow rate) when flow is routed through only three of the four sand filter vessels, the filter loading is not expected to exceed 10 gpm/ft^2.

The sand filter backwash water will be discharged to a 21,000-gallon backwash settling tank. Backflushing will be automated and sequenced with backwashing occurring at one vessel at a time, which will minimize backwash flow rates. The design backwash flow rate would be approximately 240 gpm, which would allow a relatively long hydraulic retention time in the backwash tank to provide very effective settling of backwashed solids.

CESF System Enhancements

The design of the filtration component of the CESF system has also been enhanced by adding GAC as a filter media for removal of residual VOCs and dissolved metals. Legacy VOCs tetrachloroethene, trichloroethene, and cis-1,2-dichloroethene have been detected in stormwater at concentrations less than 5 micrograms per liter (µg/L). This enhancement will also improve the removal of dissolved metals such as chromium, copper, nickel, and zinc.

Each of the 12 system sand filter vessels will be taller than a standard sand filter vessel so that 1,000 pounds (lbs) of GAC can be installed in each filter vessel. The full treatment system will therefore contain 12,000 lbs of GAC. GAC filtration is an established water treatment process that is capable of removing the VOCs of concern to non-detectable levels, and it is expected that the addition of the 12,000 lbs of GAC will reduce the observed VOC concentrations to non-detectable concentrations in the treatment system effluent. It is also expected that metals concentrations in the effluent will meet the applicable stormwater criteria (ODEQ ecological screening level values (SLVs) for all metals and Permit benchmarks for copper and zinc) with the system configured as described. However, the system components and operation can be further optimized or modified, if necessary, to meet these criteria. Potential modifications include an additional GAC vessel and/or use of coagulants, including polyaluminum chloride, to further enhance the removal of dissolved metals.

Expected Treatment System Performance

Based on operation of CESF systems for stormwater treatment at other industrial facilities, the performance of the system for pollutant removal at the PCC facility can be readily estimated. The enhanced (GAC-containing) system will be capable of reducing the concentration of copper from past measured concentrations as high as approximately 0.2 milligrams per liter (mg/L) to below the Permit benchmark concentration of 0.020 mg/L and the SLV of 0.009 mg/L. Similarly, the system will be

capable of reducing the concentration of zinc from past measured concentrations as high as approximately 2 mg/L to below the Permit benchmark concentration and SLV of 0.120 mg/L. It is also expected that VOC, nickel, and chromium concentrations in the treatment system effluent will be below the SLVs for these constituents. (There are no Permit benchmark concentrations for these constituents.) The specific removal efficiency for metals will vary slightly over time depending on the fraction of metals that are in a dissolved form.

Lastly, CESF is a proven technology for removing PCBs to non-detectable levels. For more than 4 years a similarly sized 1,500-gpm CESF system from the same treatment system supplier, Clear Water Services, has operated at a facility in Seattle, Washington. With monthly treatment system effluent sampling for more than 4 years, the results were consistently non-detect for PCBs using the prescribed EPA Method 8082, with only one detection of PCBs at a concentration greater than the laboratory analytical reporting limit.

Operation and Maintenance

The control system is automated with a programmable logic controller (PLC)-based control panel that will monitor the turbidity of treated stormwater and will recirculate stormwater back to the system storage tanks for re-treatment if necessary based on turbidity measurements above the design effluent setpoint. The system will be capable of sending remote notification to system operators for warning or alarm conditions.

An operation and maintenance manual will be provided for the stormwater treatment system. The manual will include a schedule of operation and maintenance activities. System operation will generate settled solids in the system tanks, primarily the backwash settling tank. Periodic vactor truck servicing will be required to remove the sludge at the bottom of the tanks and take the waste sludge off site for proper treatment and disposal. At the time sludges are removed, a proper waste characterization profiling of the waste sludge/solids will be conducted, but it is expected (based on past projects) that the solids generated from processing the waste sludge will be characterized as a non-hazardous waste that can be sent to a local RCRA subtitle D solid waste landfill.

If you have any questions regarding the information provided in this document, please contact the undersigned at (425) 329-0281 or via email at jkalmar@landauinc.com.

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