



Project Name: Central WWTP Capacity Improvements and CSO Reduction Project

MWS Project Number: 14-SC-0153

Last Updated: 12/19/14

BACKGROUND / PURPOSE

Metro Water Services (MWS), in order to comply with the terms of the Consent Decree between MWS, the United States, and the State of Tennessee, developed the Clean Water Nashville Overflow Abatement Program (CWNOAP) to construct infrastructure improvement projects that reduce overflows from both the separate and combined sewer systems and enhance the water quality in the Cumberland River and its tributaries. The largest combined sewer overflow (CSO) in the MWS system is the Kerrigan CSO. The Central Wastewater Treatment Plant (CWWTP) Capacity Improvements and CSO Reduction project will reduce the overflow frequency and volume from the Kerrigan CSO by increasing both the wet weather treatment capacity of the CWWTP and the overall capacity of the Central Pumping Station. The project will also add on-site CSO storage and equalization to assist in managing the dramatic flow rate increases from the combined sewer system during intense rainfall events.

The CWWTP was placed into service in 1958. It has been expanded several times to increase both hydraulic and treatment capacity and to enhance residual treatment capability. The existing CWWTP has an average rated capacity of 125 million gallons per day (MGD) with a peak secondary treatment capacity of 250 MGD. Full primary treatment of an additional 80 MGD from the combined sewer system is provided by a supplemental treatment train called the Excess Flow Treatment Unit (EFTU). Including the EFTU, the CWWTP has a total peak primary treatment capacity of 330 MGD.

In order to increase the ability of the CWWTP to manage peak wet weather flows without constructing additional primary or secondary aeration tanks and secondary clarifiers, MWS commissioned the *Central Wastewater Treatment Plant Optimization Study (Optimization Study)*. The *Optimization Study* identified limiting factors in each of the CWWTP's unit processes and confirmed that peak wet weather secondary treatment capacity could be significantly increased through upgrades to the existing headworks, secondary aeration, and final clarification systems without building new tankage. The report is available for review online at: (<http://www.cleanwaternashville.org/content/resources/technical-documents.html>).

PROJECT SCOPE

The Central WWTP Capacity Improvements and CSO Reduction project consists of improvements to existing wastewater treatment process units throughout the CWWTP including upgrades to the Central Pumping Station and the Intermediate Pumping Station, construction of approximately 15-20 million gallons (MG) of new CSO equalization storage, installation of fine screens and improvements to the grit removal system for both the CSO and separate system flow trains, replacement of the secondary treatment aeration system, addition of a new ultraviolet (UV) disinfection system for secondary plant effluent, addition of a new Peracetic Acid (PAA) disinfection system for the EFTU, and improvements to the ancillary systems required to provide a complete and functional system (site/civil; electrical; instrumentation and control (I&C) including control system improvements and integration with and upgrades to the

supervisory control and data acquisition (SCADA) system; structural; architectural; heating, ventilating and air conditioning (HVAC); plumbing; fire protection).

The project scope includes the evaluation, design, and construction administration tasks as described below.

Evaluation Tasks

The following items will require investigation by the Designer to make determinations about the overall design approach. The Designer will evaluate the pros and cons of each alternative, along with the life cycle cost/benefit, and provide recommendations to MWS.

- Evaluation of Central Pumping Station coarse well improvements
 - Using air to fluidize the coarse well
 - Building a self-flushing coarse well
 - Other alternatives developed by the Designer
- Evaluation of coarse and fine screening alternatives for flow from the Central Pumping Station
 - Implementing the *Optimization Study's* screening alternative
 - Building a new coarse screening facility (with rock trap and bypass) downstream of the Central Pumping Station and upstream of the South Grit Tank and the future equalization storage tank(s). Also, replacing the existing coarse screens with fine screens and bypass channels
 - Other alternatives developed by the Designer
- Evaluation of CSO equalization storage systems to achieve a total volume of 15-20 MG
 - Converting the currently abandoned old south treatment system tankage to equalization storage
 - New equalization storage to obtain the required storage volume
 - Pipe routing for flow to the tanks and from the tanks back into the Central Pumping Station. Use of a two-way pipe should be considered
 - Constructing a new equalization storage basin of sufficient size to hold the total required volume
 - Pipe routing for flow to the tanks and from the tanks back into the Central Pumping Station
 - Site evaluation to determine the best location (or locations) for storage
- Evaluation of the South Grit Tank system
 - Verifying that the vortex type technology is appropriate to maximize grit removal for flow from the combined sewer system and determining the upstream screening requirements to protect grit units
 - Evaluating the need to modify existing grit pumps, cyclones, or classifiers
- Evaluation of North Grit Tank system, as follows:
 - Verifying that the vortex type technology is appropriate for the separate system grit characteristics and determining the upstream screening requirements to protect grit units
 - Evaluating the need to modify existing grit pumps, cyclones, or classifiers
- Evaluation of existing return sludge pumps
 - Determining if they can be used to provide proportional flow
 - Determining feasibility of usage versus replacement because of age, mechanical condition, etc.

- Peracetic Acid (PAA) pilot test for the disinfection of flows from the EFTU
 - Providing supervision, testing protocols, and assistance as needed for the disinfection of flows from the EFTU
 - The pilot test will be performed by others.
- All evaluations required to determine the best design alternative for all design items included in the “Design Tasks” list
 - The proposer is reminded that the items listed above require decisions about modifications to the system.
 - Evaluations may also be required for items in which the design task is clear, but where the design approach may need to be determined.
 - These evaluations will choose the best ways to modify each known design element based on technical and economic factors and MWS preference.

Design Tasks

The recommended design improvements are captured in the Executive Summary of the *Central Wastewater Treatment Plant Optimization Study* (<http://www.cleanwaternashville.org/content/resources/technical-documents.html>). The Designer will design and oversee all aspects of the upgrade project to produce a completed facility with the capability to meet the performance requirements and to operate efficiently with maximum automation. The design responsibilities include all associated disciplines to complete the recommended upgrades (site/civil, electrical, I&C, structural, architectural, HVAC, plumbing, fire protection, odor control) and control system improvements including integration with and upgrades to the supervisory control and data acquisition (SCADA) system. The design will include a specification that emphasizes periodic updates to the electronic *Operation and Maintenance (O&M) Manual* and Computerized Maintenance Management System (CMMS) and delineates extensive commissioning, start-up, and training responsibilities. The upgrade recommendations are summarized below:

- Design of Central Pumping Station facilities
 - 2 new 40-MGD pumps with valve and piping systems similar to the existing installation
 - Rehabilitation and/or replacement of all existing wet well isolation gates/actuators
 - Addition of a second clamshell to the current clamshell over the Central Pumping Station wet well
 - Design of recommended improvements to the coarse well, if any (See “Evaluation of Central Pumping Station coarse well improvements” task)
- Design of the recommended screening alternative (see “Evaluation of coarse and fine screening alternatives...” task)
- Design of the recommended CSO equalization storage system alternative and all associated piping and valve modifications (See “Evaluation of CSO equalization storage systems...” task)
- Design of the conversion of the existing aerated South Grit Tanks to a vortex grit removal system including the replacement or modification of grit pumping, dewatering, and compaction equipment, as needed
- Design of canopy baffles below the inlet port and the addition of perforated target baffles to the primary settling tanks
- Design of covers over the south primary settling tank effluent launders and effluent channel for the purpose of odor control. This includes the design of the odor control duct system required to

collect the air and move it to the plant odor control system and the design of the fan or biofilter improvements, as required.

- Design of the removal of the south primary effluent channel Parshall flume
- Design of the new north fine screenings facility to screen separate sanitary system flows
 - Mechanical equipment includes screens, screen bypass, and screenings collection, compaction and disposal equipment.
 - Complete, interdisciplinary design is required.
- Design of the conversion of the existing aerated North Grit Tanks to a vortex grit removal system including the replacement or modification of grit pumping, dewatering, and compaction equipment, as needed
- Design of the new intermediate screw pumps to be located immediately west of the existing Intermediate Pumping Station
 - The capacity of the new pumps will be such that the pumping station will have the firm capacity to match the peak secondary wet weather treatment capacity.
 - Design will include the manufacturer-recommended rehabilitation improvements to the existing intermediate screw pumps and an examination of the existing structures and channels at the pumping station to determine if repairs are required.
- Design of modifications to the inlets of the eight secondary aeration tanks to achieve even flow-splitting in dry and wet weather
- Design of a new aeration system in the existing aeration tanks
 - Replacement of draft tube aeration system with a fine bubble aeration system
 - Revised layout of the existing complete mix aeration basins to achieve a system that includes an anaerobic selector and anoxic/aerobic zones for future biological nutrient removal
 - New blowers for the aeration system
 - Structural analysis to determine modifications required, if any, to the existing blower-building floor, equipment pad configuration, and associated electrical system improvements
- Design of structural components of the aeration system and effluent channels, including, but not limited to,
 - Baffle walls in the aeration tanks
 - Raising of the effluent channel walls to improve hydraulic capacity
- Design of upgraded capacity for the return sludge systems, as needed, along with provisions for equally distributing return sludge flows between the eight aeration basins
- Design of improvements to all secondary clarifiers to maximize hydraulic capacity
- Physical inspection of all clarifiers and the design of new clarifier mechanisms and rehabilitation methods and components for any structurally deficient clarifier components, as needed
- Design of new conveyance piping between the north clarifiers and the new UV disinfection facility and the modification of individual clarifier effluent pipes, as needed, to connect to the new conveyance piping
- Design of a new UV disinfection facility and all electrical and associated improvements, as required, to disinfect all secondary plant effluent
- Develop design criteria for a new PAA facility to disinfect EFTU flows
 - For all existing tankage conversions and all new structures or facilities required for the PAA disinfection system

- It is anticipated that the equipment for the PAA disinfection facility will be furnished and installed by the selected chemical supplier.
- Design of modifications to the clarifier return sludge system, including replacement or upgrades to the pumping system and piping to achieve proportional return flow during wet weather events
- Design of upgrades to the CWWTP's supervisory control and data acquisition (SCADA) system to integrate all project improvements into the system
 - The Designer will utilize the MWS system integrator, Engineering Systems, for SCADA coordination consulting during the design phase.
 - The fee for Engineering Systems will be paid for under the current MWS contract.
 - Engineering Systems will not be a sub-consultant to the Designer.
 - It is anticipated that Engineering Systems will be assigned as a subcontractor to the successful construction contractor for the manufacture and installation of hardware along with the programming and configuration of software for the necessary system upgrades.
- Prepare specifications that adequately describe all technical requirements of the project equipment, materials, and installation procedures. Specifications will clearly define the contractor's responsibilities for the electronic *O&M Manual*.
- Design of any flow meters that may require replacement based on the useful life of the existing flow meters
- Design of butterfly valve and butterfly gate replacements
- Determination and design of the ultimate use of the old south aeration tanks and two empty cells of the old secondary clarifiers
- Design of optimization protocols for existing coarse bubble aeration/mixing systems throughout the CWWTP
- Demolition design of the following facilities:
 - Abandoned south grit odor control system
 - Maintenance office adjacent to the east wall of the South Primary Settling Tanks. Note that a natural gas pipe is present in this vicinity, so coordinate with CWWTP staff to locate this pipe.
 - Limited demolition of tertiary filter treatment tanks
 - Tertiary filter backwash screw pumps and filter backwash tanks
 - Turbine installed adjacent to the filter backwash tanks
 - Existing plant disinfection facility at the EFTU and at the treated plant effluent chlorination/dechlorination facility
 - All demolition required for construction of CSO flow equalization storage
 - All demolition required for construction of north screenings facility
- Where new work requires stormwater BMP design, perform the design to conform with MWS Stormwater requirements
- Design of all required site work in accordance with the Scope of Work, Section 4.05
- Design of recommended flood mitigation improvements for the Central Biosolids facility and the CWWTP as detailed in the *Post-May 2010 Flood Report* dated May 2014
- Design of recommended process improvements for the Central Biosolids facility as detailed in the *Biosolids Facility Assessment* by Brown & Caldwell dated October 2014
- Design of existing electrical system improvements as detailed in the *CWWTP Electrical System Assessment* dated December 2014

Miscellaneous Design Tasks

- Geotechnical investigations, as needed
- Preparation of all permits for the proposed work (See below)
- Preparation of a *Maintenance of Plant Operations (MOPO) Plan* that provides general guidelines and procedures for maintaining plant treatment capability during construction (See below). Plan must be prepared as a project specification.

Construction Administration Services Tasks

The Designer will provide construction administration services during the construction cycle of each construction contract. The level of effort will be defined during Phase 2 / Phase 3 contract negotiations. During this negotiation, the division of duties and corresponding work responsibilities for the CWNOAP Construction Management Consultant staff and Designer's staff will be determined. The Designer's work effort may consist of any or all of the following tasks:

- Respond to contractor requests for information and requests for clarification
- Administer the contractor submittal and shop drawing review and approval process
- Conduct construction meetings on behalf of MWS
- Review contractor Change Order requests and submit written recommendations to MWS
- Assist with updates to the electronic *O&M Manual* with data from upgraded and new unit processes. The existing electronic *O&M Manual* prepared for the Central Biosolids facility may be utilized if it can subsequently be updated by plant staff for future modifications. If this is not feasible or desirable, the Designer may need to develop a new, separate electronic *O&M Manual* platform.
- Provide resident engineering staff as appropriate for the work being performed at the site. More than one resident engineer may be necessary at any given time depending on the level of construction being performed.
- Provide startup, commissioning, and training services, which may include any or all of the following:
 - Review of contractor startup, commissioning, and training plans
 - Administer the startup and training schedule, including conducting any required meetings
 - Witnessing of field startup testing
 - Preparation of testing reports
 - Coordination and administration of the resolution of startup and commissioning issues that arise
- Perform project completion inspections (Substantial Completion, Final Completion, Warranty Inspection)
 - Coordinate inspection times with contractor and MWS staff and the CWNOAP Project Manager
 - Perform inspections
 - Prepare and issue punch list documentation by coordinating with all inspecting parties
 - Prepare letters of Substantial Completion, Final Completion, Warranty Review Comments, and Warranty Issues Resolution

FEASIBILITY/RISK ASSESSMENT/CRITICAL PATH ITEMS

- Easement Acquisition: Temporary construction easements may be required, depending on the location of Central Pumping Station improvements, the new CSO equalization storage tanks, or the new north screening facility. The need for temporary construction easements will be determined during design.
- Additional Site Constraints: Operations at the CWWTP will need to be maintained at full or near-full capacity during construction. The *MOPO Plan* must be prepared and approved by MWS (See separate section below).
- Site Security: In conjunction with MWS staff and in accordance with MWS security protocols, a *Site Security Plan* will be developed. Elements of this plan may include, but not be limited to, background checks on all people with access to the site or to MWS computers, the installation of additional security cameras, the hiring and scheduling of additional security guards at plant entrances and walking the site, etc.
- Hazardous Materials: Where construction requires the modification or demolition of any existing facility and/or structure, a review must be performed to determine if the work encounters any hazardous substances (asbestos, waste oil, wastewater, wastewater residue, etc.). A *Hazardous Materials Plan* will be prepared to account for every known hazardous material that has the potential to be encountered and its subsequent amelioration/mitigation/disposal/safety requirements.
- Permits: See the permit section below.
- Archeological: There are no known archaeological issues on this project. All modification work will be performed in previously reviewed and vetted areas. It is noted, however, that an archeological review may be required for the yet-to-be-determined site of new storage tank.
- Geotechnical: Geotechnical reports and information exist from many prior construction projects and should be referenced to the extent that they are available. Due to variability of soils and rock formations, though, it is understood that additional geotechnical work is required to obtain specific information at new structure locations. It is expected that the Designer will take full responsibility for any new geotechnical work.

MAINTENANCE OF PLANT OPERATIONS (MOPO) PLAN

The process train improvements described in this document directly impact the ability of the CWWTP to treat wastewater and maintain compliance with effluent water quality standards during construction. Impacts to treatment processes must be minimized at all times. The Designer will develop a *MOPO Plan* as a specification section within the contract documents. The *MOPO Plan* will not dictate contractor's means and methods. Its intent is to inform the contractor about constraints that will be encountered during construction and the appropriate responses to these constraints.

PERMITTING

The following permits/activities were identified as potentially required for this project; however, further evaluation of the need to acquire these permits (and any other permits not listed below) will be conducted by the Designer:

- NPDES Stormwater Construction Permit (TDEC, MWS)
- Floodplain Variance (MWS)

- Grading Permit (MWS)
- Building Permit (MWS)
- Plans and specs approval/Authorization for Construction (TDEC)
- Erosion Prevention and Sediment Control – Inspection during Construction (TDEC, MWS)
- Section 106 Permit (Tennessee Historical Commission), with archaeological review if required

REFERENCE MATERIALS

The following reference materials are available electronically on the Clean Water Nashville website under the Technical Documents information, unless otherwise noted:

- *Central Wastewater Treatment Plant Optimization Study*
- National Pollutant Discharge Elimination System (NPDES) Permit (in the *Central Wastewater Treatment Plant Optimization Study*)
- Consent Decree
- *Long Term Control Plan*
- *CWWTP Post-May 2010 Flood Report* dated May 2014
- *CWWTP Biosolids Facility Assessment* dated October 2014
- *CWWTP Electrical System Assessment* dated January 2015
- *CWWTP Electrical Equipment Condition List* dated December 2014