

AZ Water Student Design Competition 2021

Project

New Gilbert North Water Treatment Plant (NWTP)

Project Components

- Determine Design parameters based on projected population growth
- Treatment Process Decision Matrices
- Plant and Process Optimization
- Preliminary Design and Hydraulic Profile
- Preliminary evaluation for capital and operational costs

Background

The North Water Treatment Plant (NWTP), is located on Guadalupe Road and Higley Road and is owned and operated by the Town of Gilbert. The Facility was constructed in the late 90's for an initial capacity of 15 MGD and expanded in 2002 to a maximum month flow of 45 MGD. NWTP receives its source water from SRP via the Eastern Canal. SRP manages several dams and reservoirs on the Salt and Verde rivers and several dams east of Phoenix. The water is conveyed to Gilbert through a series of canals, including the Eastern Canal. The facility is operational year-round except when the SRP conducts periodic canal dry-ups in order to perform construction and maintenance in and around the canals. The NWTP site also includes one groundwater well, that is used to blend the NWTP surface water just prior to the finished water reservoirs to manage arsenic and nitrate concentrations. Groundwater can also be blended at the front of the plant.

The facility treats source water using conventional treatment, ozone, a combination of anthracite and granular activated carbon (GAC) filters, disinfection, and finished water reservoirs prior to distribution.

The watershed that supplies the source water has experienced increased fires and prolonged periods of drought which have affected the water quality by increasing the total organic content ("TOC"). The higher TOC levels result in the development of Disinfection By-Products ("DBP's") that are regulated by the EPA's Safe Drinking Water Act. The DBP's develop very quickly in the storage reservoirs after chlorination of the water to approximately 1.5-mg/l using sodium hypochlorite. The DBP's are measured in the distribution system as total trihalomethanes (TTHM). If the TOC levels could be maintained below 2.0-mg/l in the finished water, then the Town would be able to effectively manage TTHM development in the distribution system.

Problem Statement

The Town of Gilbert's NWTP is a conventional surface water treatment facility, and the process cannot be improved any more to handle the high levels of organics arriving in the source water canal. As such, the Town requires a new WTP with processes that will consistently lower the TOC levels below 2.0-mg/l in the finished water.

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The project team shall evaluate and summarize historic water flow rates and related raw water parameters based on the flow and water quality data from 2018 to 2020. Teams shall then determine the design criteria to be used for the design of the new NWTP. The design criteria for the project will be a combination of the Town's required treatment capacity based on population models, the team's analysis of historical water quality data, and current and emerging drinking water regulations.

Each team shall design a new water treatment to replace the existing NWTP based on solely the SRP source water under the assumption that no groundwater will be used. Teams shall research, identify, and evaluate current and emerging treatment process that can be used to treat the raw water and meet drinking water standards for the Town of Gilbert. As part of the evaluation, the project team shall also recommend solids management. Emphasis shall be placed on optimizing the process for overall treatment efficiency including chemical and energy use.

The project shall include the following components:

1. Establish design criteria for the new NWTP based on an analysis of the historical flow rates, projected population growth, pertinent water quality data, and existing and emerging drinking water regulations.
2. Research and recommend existing or emerging treatment process technologies using a Decision Matrix which evaluates, at a minimum: initial investment and total lifecycle cost, social and environmental factors of the treatment process.
3. Selection of desired treatment process/technology using a Decision Matrix which includes, at a minimum: feasibility/constructability, lifecycle costs, maintenance and operation requirements, staffing levels, process efficiency improvements, etc.
4. Design and layout of the new NWTP plant.
5. Final report shall be a Basis of Design Report that presents and discusses the following:
 - a. Summary of historical operating data, regulations, and determination of design criteria.
 - b. Evaluation and selection of treatment process technologies including a lifecycle cost analysis.
 - c. Summarize construction sequencing as well as proposed staffing levels required.
 - d. Provide Engineer's Opinion of Probable Construction Cost estimate based on the ACE Class IV – Study or Feasibility level.

Additional Information to be Provided at Kickoff

1. Flow and Water Quality Data (2018-2020)
2. *Existing Facility Basis of Design Report*
3. Selected As-Built Drawings