

## Technical specifications

The raw wastewater enters manual coarse screen with bar space 20 mm used to protect process equipment from big solids. Collected screening is transferred to rubbish mobile container manually. The screened wastewater is entered to primary sedimentation and oil removal tank. The API separator is a gravity separation and the design of the separator is based on the specific gravity difference between the oil and the wastewater because difference is much smaller than the specific gravity difference between the suspended solids and water. Most of the suspended solids will settle to the bottom of the separator as a sediment layer, the oil will rise to top of the separator, and the wastewater will be the middle layer between the oil on top and the solids on the bottom. Typically, the oil layer is skimmed off to oil collection tank and the bottom sediment layer is removed by oil and sludge scraper in sludge hopper and then is transferred to sludge sump by gravity. For damping of wastewater flowrate and characteristics variation, wastewater is sent to two equalization ponds in order to achieve a constant or nearly constant flowrate. After equalization unit, wastewater is entered to wastewater pump station and then pumped by submersible pumps to the next unit (Flash mixing unit).

In order to prevent from the precipitation of calcium and magnesium salts in the reverse osmosis unit and also reduction of treated wastewater hardness, Lime-Soda softening process is considered as a chemical/physical unit. Adding lime and sodium carbonate to water leads to the formation of insoluble calcium and magnesium compounds that can be flocculated and quickly deposited. In addition to lime and soda ash, Iron (III) Chloride as a coagulant and polyelectrolyte as coagulant aid are injected to flash mixing tank. Wastewater enters a two-stage rapid mixing system in which firstly lime and soda ash are injected, and in the second stage, Iron (III) Chloride and polyelectrolyte are added to the wastewater. After coagulation unit, wastewater enters to two clariflocculators. Clariflocculator is a combination of flocculation and clarification in a single tank. It has two concentric tanks where inner tank serves as a flocculation basin equipped with paddle type mixers and the outer tank serves as a clarifier. In sedimentation unit, produced sludge is collected in clarifier hopper through peripheral sludge scraper and then is transferred to sludge storage tank. Because of the fact that effluent from sedimentation unit is saturated with calcium carbonate salt, clarified wastewater should be transferred to pH adjustment tank in order to prevent from precipitation of salts in pipe and reverse osmosis unit by acid injection.

For removing the remaining suspended solid, acid injection tank effluent is sent to three micro drum filters. Micro drum filters are equipped with horizontal axis of rotation. Drum is hanged on two drive belts and is equipped with filtration cloth. Filtration cloth makes a barrier to the flowing water. The impurities are caught on the cloth and further washed into the sludge tank with backwash system. Filtration cloth is fixed on special plastic segments, which can be easily, with no need of tools,

fixed on drum. Backwash system is connected to the backwash pump which pumps already filtered water for cleaning the cloth.

The next unit considered for this plant is reverse osmosis unit. The first step in this unit is antiscalant injection in order to prevent from precipitation in reverse osmosis membrane. After that wastewater is lead to 5 micron cartridge filters. Filtered wastewater is pumped by high pressure pumps to two modules that each of them consists of 2 stages (Stage 1: 14 pressure vessels and 84 membranes, Stage 2: 7 pressure vessels and 42 membranes). Due to the passage of wastewater into membranes, dissolved solid in wastewater are removed and permeate water is collected in the center of membranes and then transferred to treated wastewater storage tank.

The produced sludge in chemical treatment unit enters two gravity thickeners. Gravity thickening is one of the most common methods used in a tank similar in design to a conventional sedimentation tank. Normally, a circular tank is used, and dilute sludge is fed to a center feed well. The feed sludge is allowed to settle and compact, and the thickened sludge is collected through sludge collecting equipments and withdrawn from the conical tank bottom. Thickened sludge is transferred to sludge drying bed as dewatering system. Polymer feed pump, and polyelectrolyte preparation unit is prepared for thickening unit.