METITO

Commitment to a Cleaner Environment

A Case Study

RO Pilot Plant - Qatar

Introduction

The State of Qatar has a number of Wastewater Treatment Works (WWTW) from where treated sewage effluent (TSE) is distributed mainly for irrigation purposes. The Public Works Authority, Drainage Affairs (PWA DA) has identified the potential to enhance the treatment of municipal foul sewage to improve the quality of treated sewage effluent (TSE), thereby expanding the range of TSE re-use applications. The DA proposed that the enhanced treatment process be based on membrane technology, which has evolved as one of the front-runners in the field of Advanced Wastewater Treatment (AWWT). Drainage Affairs expressed their desire to investigate the viability of membrane technology in the State of Qatar by means of a Pilot Plant Study.
The Pilot Plant Study was to be located at the Doha West STW, about 30km from Doha International Airport. The operation would test the overall feasibility of the membrane AWWT process, and the extent to which TSE could be purified by each type of pre-treatment process under study.

Scope of Work

The scope of the pilot study phase included supply, installation and operation of a Pilot Plant. Depending on the success and feasibility of the study, a second phase would include the installation of large scale plant(s).

Plant General Information

Brief description of the pilot plant:

The Pilot Plant was provided in a containerized form, thus allowing flexibility of relocation to any site. The plant consisted of four pre-treatment units operated in parallel, feeding one Reverse Osmosis (RO) train. These

treatment units include Micro-filtration (MF) and Ultra-filtration (UF). During normal operation of the plant, filtrate form the UF stage is collected in a break tank and fed to the RO train. However, provisions were made to feed the RO train using filtrate from any of the filtration units.

Feed water from the TSE wet well is pumped to a buffer tank by means of a submersible pump. The buffer tank acts as a steady source of water to all four pre-treatment units that are in parallel operation at the same time. The filtrate and product are returned back to the TSE wet well. Effluent/water containing hazardous/cleaning chemicals is collected in a holding tank and is then pumped to a designated location inside the works.

The Pilot Plant is PLC based, fully automated with minimum manual intervention. It is equipped with local instruments to check operational parameters such as flow, pressure and conductivity as well as other critical parameters. Initiation of operation is manual.

Each filtration unit is able to operate independently. All operations such as start up / stop, flushing and backwashing are automatic. All the cleaning systems are clean-in-place (CIP) type, and all units are equipped with individual flushing/cleaning facilities.

The RO train has the capacity to treat a flow of 45m^3/h. Each membrane pre-treatment unit is designed to produce sufficient water to feed the RO train and the water needed for other services such as backwash.

Plant Technical Features

Process description

The pilot plant consists of two pre-treatment units running in parallel as Duty / Standby, and one RO train. These pre-treatment units are membrane type filtration that includes Micro and Ultra-filtration. During normal operation, filtrate from pretreatment is collected in the Filtered Water Tank and fed to the RO train. However, provision is made to run the RO train using filtrate from any one of these filtration units. Each unit is able to operate independently.

Feed water from the TSE wet well is delivered to the buffer tank via submersible pumps. The buffer tank acts as a steady source of water to the two filtration units running in parallel. Filtrate and product water are lead back to the TSE wet well. Water containing chemicals in high concentration, i.e. UF and MF chemical backwash water, is collected in a chemical waste holding tank where it is neutralized and sent back to the TSE wet well.

Process Flow

1st Option MF/RO :

TSE Wet Well Pumps → Pre-Chlorination Dosing → Coagulant Dosing → MF Feed / Backwash Pump → MF Self Cleaning Filte→Micro Filtration Unit→Filtered Water Tank→ RO Feed Pump →Ultraviolet Unit→Cartridge Filter →Acid Dosing →Antiscalant Dosing → SBS Dosing→RO High Pressure Pump→Reverse Osmosis Unit→Discharge Water Tank→Wet Well

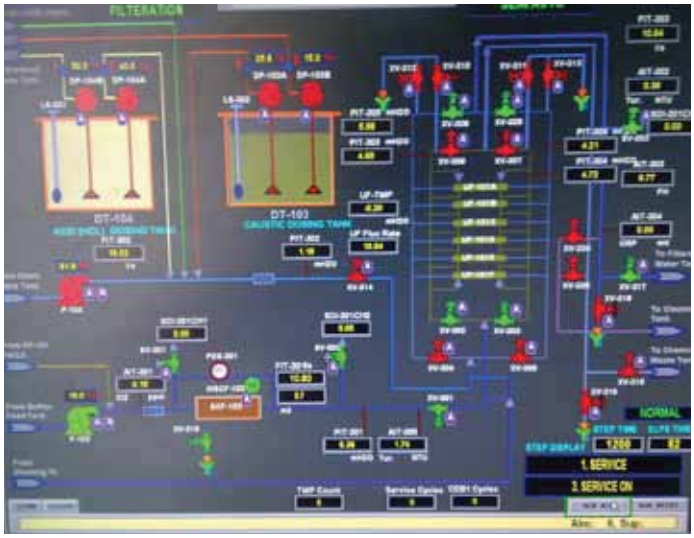
2nd Option UF/RO :

TSE Wet Well Pumps → Pre-Chlorination Dosing→ Coagulant Dosing →UF Feed Pump → UF Self-cleaning Filter→ Ultra - Filtration Unit→ Filtered Water Tank →RO Feed Pump →Ultraviolet Unit→ Cartridge Filter → Acid Dosing→ Antiscalant Dosing→ SBS Dosing →RO High Pressure Pump → Reverse Osmosis Unit → Discharge Water Tank→ Wet Well.

The test programme for the pilot plant was intended to achieve the following :

- Demonstrate the technical feasibility of the Reverse Osmosis Technology
- Provide a working model to demonstrate the suitability of the process
- Implement a wide range of TSE analyses from the selected intake point, and subsequently test the quality of treated effluent after various stages of treatment
- Verify plant design conditions with particular reference to:

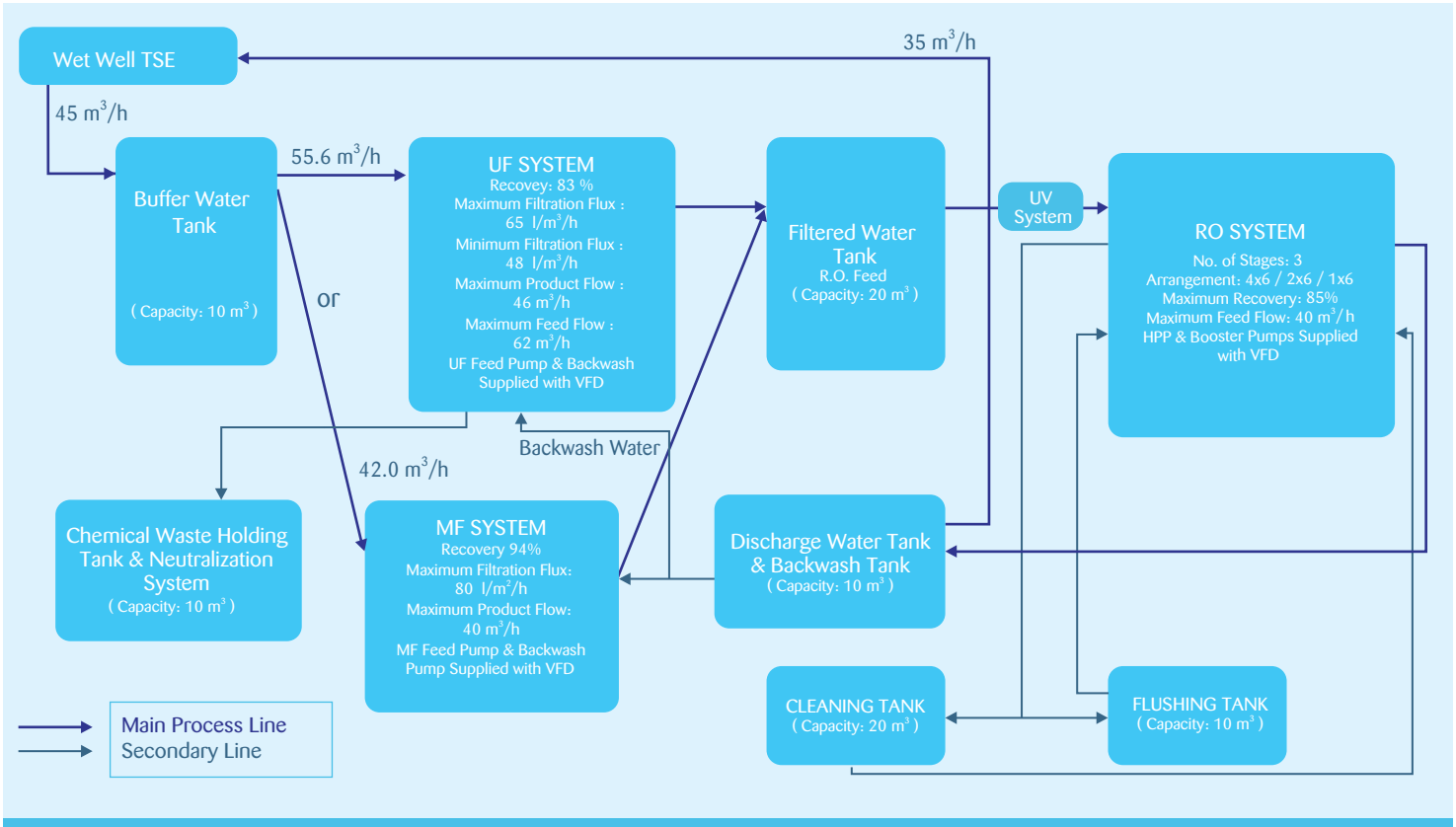
1. The effectiveness of the proposed pre-treatment stages under various operating and expected TSE conditions. This would involve evaluation of the TSE conditions as well as the TSE feed water silt density index (SDI), cartridge filter replacement rate, fouling rate of Micro-filtration (MF), Ultra-filtration (UF), and RO membranes and chemical dosing rates.
2. The effectiveness of the proposed membrane system, in particular with respect to the product water quality.
3. RO system process parameters by:
   - 3.1. Testing the proposed membrane process parameters (recovery ratio and flux rate)
   - 3.2. Testing the effectiveness of the membrane cleaning procedure
   - 3.3. Testing the correct dosage of the scale inhibitor



METITO

Commitment to a Cleaner Environment

Metito was proud to be involved in this project. Once proven, the technology would open new horizons for reuse. One of the pioneering ideas for reuse is Aquifer Storage and Recovery (ASR), which PWA has been contemplating. If applied, this will be the first of its kind not only in the Gulf region but in all of the Middle East and Arab World. Under this scheme, treated water is injected in the aquifer to create strategic storage facilities where fresh water can be withdrawn for future potable or other uses, thus adding to the renewable water resources of the country.



RO Pilot Plant Block Flow Diagram

Local presence, global know how

www.metito.com