Introduction:

- The reclamation process at the “Shafdan” includes 1) primary clarification; 2) activated sludge; and 3) tertiary soil aquifer treatment (SAT) with hydraulic retention times (HRTs) of a few month, which lead to the following malfunctions:
  - Increasing hydraulic load with strongly required HRT for DOC removal.
  - Long HRTs with high oxygen demand along the SAT result in anoxic conditions and mobilization of dissolved manganese from soil.
  - The occurrence of persistent trace organic compounds (TrOCs) in reclaimed water.

Objectives of this research:

This research focused on the combination of biofiltration prior and following ozonation as alternative treatment in order to:

- Reduce footprint of the existing SAT;
- Eliminate residual TrOCs;
- Minimize Mn$^{2+}$ mobilization.

Experimental:

- The pilot system included biologically active high-rate filtration unit, ozonation unit and short SAT facility (figure 1).
- Biofiltration unit: Included coagulation/flocculation with 5 min HRT and addition of hydrogen peroxide to provide oxygen for microbial processes and it was operated in a modified active dual media filter combined infiltration and backwash cycle.
- Ozonation unit: Ozone was produced from pure oxygen and operated in continuous mode.

Results and Discussion:

- Biofiltration as pretreatment for short SAT showed complete nitrification with efficient removal of NH$_4^+$ and NO$_2^-$ (Figure 2).
- Biofiltration reduce DOC concentration in about 17-22% in the secondary effluent (Figure 3).
- Ozonation increased NO$_3^-$-N concentration (Figure 2b).
- Efficient reduction of UVA (60%) observed by ozone (Figure 3b).
- Biofiltration reduce the concentrations of ACS and IOP from the TrOCs group by approximately 60% and 30%, respectively but not significantly (Figure 4).

Conclusions:

- Incomplete nitrification during secondary treatment lead to clogging in the reclaimed water.
- As a result of the pretreatment of biofiltration and ozonation the oxygen demand in the process was reduced and additional DO during SAT was succeeded.
- Improvement of the reclaimed water was achieved.

Analytical methods:

- The target compounds of TrOC were detected and quantified by HPLC.
- TOC, DOC, Nitrogen compounds and bromate were determined by TOC analyzer, spectrophotometer and ion chromatography.