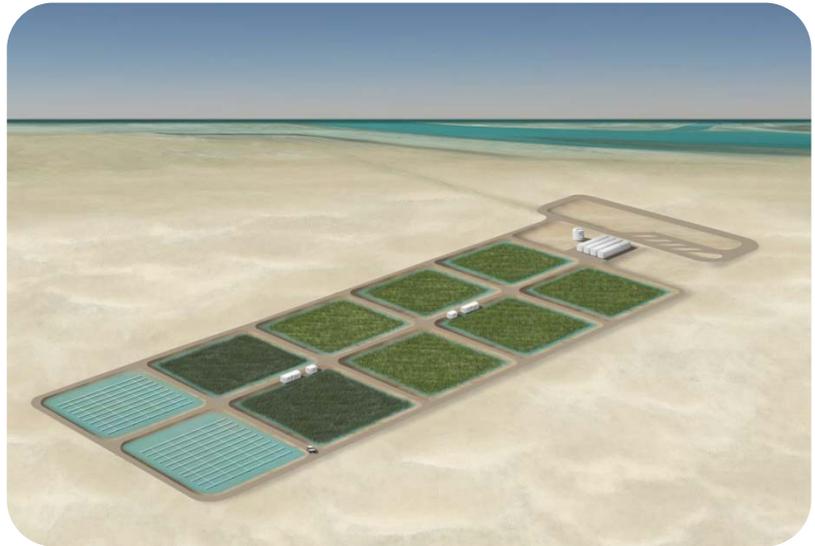


In 2011, Roux Associates was retained to design a natural wastewater treatment solution for a 1,250 hectare (3,000 acre) new industrial facility in Saudi Arabia. Upon completion the facility will include a refinery, smelter, cast house, and rolling mill. Roux Associates was tasked to design an Engineered Natural System (ENS®) to treat all wastewaters (sanitary, process and stormwater) from construction through operation, incorporate transitioning through phases, and plan for future expansion of the facility and increased wastewater flow rates.



The 9-hectare (23-acre) ENS® was designed to treat a total flow of 5,445 m<sup>3</sup> per day (1.4 million gallons per day) without the addition of chemicals or the creation of odors associated with conventional tank systems. The major system components include:

- Dump station with truck hook-up ports to collect and convey sanitary wastewater during construction of the industrial facility;
- 1,000m<sup>3</sup> primary sedimentation and anaerobic treatment tanks which break down and separate organic material in the water;
- 1,000m<sup>3</sup> oil/water separator;
- Patented enhanced subsurface flow constructed wetlands which utilize micro-organisms and vegetation to remove organics and nitrogen;
- Downflow soil filters for disinfection and phosphorus removal;
- UV disinfection system;
- 1,000m<sup>3</sup> treated water holding tank and pump station which conveys the treated water back to the facility for reuse;
- Infiltration basins; and
- Innovative treatment cells to remove fluoride from facility stormwater runoff.

The effluent from the wetlands is reused in the manufacturing process and for irrigation, thus reducing water demand by over a million gallons per day and saving more than \$7 million annually that would otherwise be used to purchase fresh water. In addition to saving water and money, the wetland treatment system was constructed six months faster than a conventional tank-based system and eliminated an estimated 1,000 metric tons of steel for piping and tanks.