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## Energy and Environment - Poster Display

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### Environmental Evaluation Risk Assessment and Management options of Abu Nakhla Treated Sewage Effluent TSE Unlined Pond Doha Qatar

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The rapid economic and population growth of Qatar during the last few decades led to generation of substantial volume of municipal treated sewage effluent (TSE). Most of this water was disposed into Abu Nakhla depression at the outskirts of Doha city since 1985. Abu Nakhla depression is situated at the southwest of Doha. The mixture of these effluents with surface and ground waters during rainy seasons created a conspicuous water body of around 2 by 3 km. For many years, this pond was the source of many adverse environmental effects such as bad odor, vermin and elevated groundwater levels in the neighboring residential areas. The claims that some of the disposed water was untreated aggravated the situation and the local community considered the pond as impure body of water. A multiproxy study was carried out during 2014 and 2015, including remote sensing, geological, geophysical (resistivity-tomography) and geotechnical investigation of the pond origin and evolution. Hydrogeological and hydrochemical analyses of water samples collected from 24 observation wells drilled around the pond. These studies revealed that, the upper part of the subsurface geology of the pond site is composed of Tertiary carbonate rocks of the Simsima/Umm Bab member and Midra shale member of the Dammam Formation, which is underlain by the Rus Formation, both of Eocene age. In Qatar, the Simsima/Umm Bab member represents the shallow

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groundwater aquifer, while the Rus is the upper principal aquifer. The upper part of the Simsima/Umm Bab member is characterized by the presence weathered weak zones, cracks and fissures, which enable infiltration of the pond water to recharge the aquifers. The pond has a rich and diverse population birds, fish and frogs, hosting about 260 bird species, such as 150+ Greater Flamingo (*Phoenicopterus roseus*). It also hosts about 10% of the total plants species in Qatar, such as: *Phragmites australis*, *Typha dominguensis*. Water analyses have shown that, the water in the pond was of good quality, in terms of physiochemistry and biological and microbial contaminants. This is due to Qatar's use of advanced wastewater treatment technologies, with ultrafiltration and ultraviolet (UV). Heavy metals concentration in the water of the pond, was very low. Analyses conducted in May 2014 indicate that most of the heavy metals levels were below the international FAO limits for irrigation water (FAO,1985), such as: Ni concentration was 2.4 mgL<sup>-1</sup>, FAO limit is 200 mgL<sup>-1</sup>. As concentration was 1.0 mgL<sup>-1</sup>, FAO limit is 100 mgL<sup>-1</sup>. Pb concentration was 0.8 mgL<sup>-1</sup>, FAO limit is 5000 mgL<sup>-1</sup>. Cd concentration was 0.0 mgL<sup>-1</sup>, FAO limit is 10 mgL<sup>-1</sup>. The results of our 3D groundwater numerical modelling, indicated the loses of about 5% of the pond water per day, due to high infiltration and evaporation rate. This causes the rising of water table in the neighboring areas. The pond represents a breeding ground for mosquitos. The presence of snails may also act as incubators for some parasites. Management options of the pond site, have been recommended. These include, changing the area into natural reserve, artificial oasis, and can serve as a meteorological station.