

Groundwater quality in central Tokyo and its potential for turf irrigation

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Groundwater is available inside urban areas and therefore has high potential to meet urban water demands. Groundwater has been used as a source of drinking water, industrial water, and bathing water for public bath, while minor and potential use of groundwater includes toilet flushing water, ambient water, landscape irrigation water, recreational water, and water at emergencies. For a sound management of groundwater, it is essential to achieve proper abstraction and adequate allocation of groundwater, based on the scientific data of quantity and quality. Groundwater is commonly considered clean, which is not necessarily true with groundwater in urban areas. Our research had examined 204 of groundwater samples at 147 sites including unconfined aquifers, confined aquifers, and springs in 2005-2009. The observed data was compared with several regulations for specific purposes to propose a way of groundwater usage, assuming groundwater treatment process if required. We have previously reported the potential of groundwater to mitigate "heat island problem" by irrigation and the potential to meet water demand at emergencies.

In this study, the use of groundwater for turf irrigation was examined, following a project to put turfs at all schoolyards of about 300 hectare promoted by the Tokyo Metropolitan government. This project is expected to work for heat island mitigation, CO₂ reduction, educational effects and amenity improvement. As another positive impact of the project, this study focused the potential of turfs to humidify the ambient air in central Tokyo which is suffering from very dry atmosphere in winter seasons. Some surveys pointed out the relationships between humidity and the incidence of influenza, and between humidity and the occurrence of fire, suggesting that very dry condition with extremely low humidity is deteriorating the urban life environment. Accordingly, this study performed laboratory-scale experiments to determine the effects of turf irrigation to humidify ambient air, and the results were used to estimate the required amount of water to provide certain humidification impacts in central Tokyo.

Furthermore, the potential of groundwater to meet the water demand for turf irrigation were determined based on the observed groundwater quality in comparison with the current regulations identifying pH, smell, appearance, Escherichia coli, turbidity and color to be monitored for irrigation. Groundwater samples meeting with all these parameters were identified good for irrigation after simple chlorination, those exceeding the target value of turbidity were categorized applicable for irrigation after chlorination if manually irrigated, and the remainings were identified not applicable for irrigation. Turf irrigation systems using tap water and groundwater were compared regarding the maintenance difficulty, operational cost, safety and stability of the system. Finally, the potentials of groundwater for turf irrigation in central Tokyo were evaluated in the viewpoints of both quality and quantity.

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