Use of beach galleries as an intake for future seawater desalination facilities in Florida and globally similar areas

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\textbf{ABSTRACT}

Desalination of seawater using the reverse osmosis process can be made less costly by the use of subsurface intake systems. Use of conventional open-ocean intakes requires the addition of a number of pretreatment processes to protect the primary RO process. Despite using the best designs possible for the pretreatment, seawater RO membranes tend to biofoul because of the naturally-occurring organic material and small bacteria present in seawater. These materials are not completely removed by the pretreatment system and they pass through the cartridge filters into the membranes, thereby causing frequent and expensive cleaning of the membranes. Quality of the raw water can be greatly improved by the use of subsurface intakes which can substantially reduce the overall treatment cost. There are a number of possible subsurface designs that can be used including conventional vertical wells, horizontal wells, collector wells, beach galleries, and seabed filters. The key selection criteria for the type of subsurface intake most suited and most cost-effective for a site are based on the required volume of raw water and the local geology. The active shorelines of Florida are very well-suited for the development of beach gallery intake systems. These systems are installed beneath the active beach between the high and low tide zones of the beach. Since they are constructed with a depth to the screens between 3 and 5 m, they cannot be observed at surface and persons using the beach would be unaware of their existence. These galleries are simple to construct and they tend not to clog because the active wave action within the intertidal zone provides mechanical energy that continuously cleans the filter face. They also have other advantages, including: the water quality is seawater unaffected by substances present in freshwater aquifers occurring landward of the shoreline, the salinity of the water is generally constant, and there are no impacts on water users located inland from the shoreline. A comprehensive study of the grain size characteristics of Florida beaches has allowed an assessment to be made of the hydraulic conductivities of the Florida beach sands. Hydraulic conductivity values generally range from 1.8 to 24 m/day, which is more than sufficient to allow the design and construction

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of high-capacity galleries at a reasonable cost. This type of intake is particularly relevant to the northeast Florida shoreline adjacent to an area being considered for development of a large-capacity seawater desalination system.

Keywords: Seawater reverse osmosis; Desalination; Intake; Beach gallery; Design; Florida