Industrial parks can achieve the cooperative utilization of resource among multiple enterprises, and have become a major trend of process industry. Concerning the combined consumption issue of water and energy in industrial parks, this paper presents a methodology for interplant heat-integrated water allocation network (IHIWAN) synthesis, to explore the potential of water and energy conservation in industrial parks. The novel model proposed takes both direct and indirect scheme of cross-plant water reuse into consideration, and develops strategies for heat integration specific to industrial parks. The economically optimal overall IHIWAN is pursued by mathematical programming under the objective of minimum total annual cost (TAC). Based on superstructure, a non-linear programming (NLP) model is formulated containing two sub-networks: water allocation sub-network and heat exchanger sub-network. With regard to the two sub-networks, the overall network is synthesized in two solution approaches respectively: sequential design and simultaneous design. Through the comparison between these two approaches, it is indicated that simultaneous design presents preferable result, despite the higher requirement on solution process. The effectiveness of the proposed methodology is illustrated by a case study of an industrial park including three plants.