This paper presents the results of an experimental investigation of the backfilling of scour holes around circular piles. Scour holes around a pile are generated either by a current or a wave. Subsequently, the flow climate is changed from current to wave, combined waves and current, or wave to a smaller wave, leading to the backfilling of the scour hole. The investigation has shed light onto the mechanism behind the backfilling process. The results show that the scour depth corresponding to the equilibrium state of backfilling is the same as that corresponding to the equilibrium state of scour around the pile for the same wave (or combined waves and current) climate. The time scale of backfilling has been determined as a function of three parameters, namely, (1) the Keulegan-Carpenter number of the initial wave or current (which generates the initial scour hole); (2) that of the subsequent wave, which backfills the scour hole; and (3) the Shields parameter associated with the latter wave, for live-bed conditions. In the case of the combined waves and current, the current-to-wave-velocity ratio is also involved. The time scale of the backfilling process is completely different from that of scour. The time scale of backfilling is much larger than that of scour when the Keulegan-Carpenter number associated with the backfilling is \( KC_f < O(10) \) (typical wind farm application), while the time scale of backfilling can be smaller than that of scour when \( KC_f >> O(10) \). DOI: 10.1061/(ASCE)WW.1943-5460.0000161. (C) 2013 American Society of Civil Engineers.