The local still water depth shall be calculated using Eq. 5.4-3, unless more advanced procedures or laboratory tests permitted by this section are used.

$$d_s = 0.65(\mathrm{BFE} - \mathrm{G}) \qquad (5.4\text{-}3)$$

where

BFE = BFE in ft (m)
G = ground elevation in ft (m)

5.4.4.1 Breaking Wave Loads on Vertical Pilings and Columns

The net force resulting from a breaking wave acting on a rigid vertical pile or column shall be assumed to act at the still water elevation and shall be calculated by the following:

$$F_D = 0.5\gamma_w C_D D H_b^2 \qquad (5.4\text{-}4)$$

where

F_D = net wave force, in lb (kN)
γ_w = unit weight of water, in lb per cubic ft (kN/m^3), = 62.4 pcf (9.80 kN/m^3) for fresh water and 64.0 pcf (10.05 kN/m^3) for salt water
C_D = coefficient of drag for breaking waves, = 1.75 for round piles or columns and = 2.25 for square piles or columns
D = pile or column diameter, in ft (m) for circular sections, or for a square pile or column, 1.4 times the width of the pile or column in ft (m)
H_b = breaking wave height, in ft (m)

5.4.4.2 Breaking Wave Loads on Vertical Walls

Maximum pressures and net forces resulting from a normally incident breaking wave (depth-limited in size, with $H_b = 0.78d_s$) acting on a rigid vertical wall shall be calculated by the following:

$$P_{\max} = C_p\gamma_w d_s + 1.2\gamma_w d_s \qquad (5.4\text{-}5)$$

and

$$F_t = 1.1C_p\gamma_w d_s^2 + 2.4\gamma_w d_s^2 \qquad (5.4\text{-}6)$$

where

$P_{\max}$ = maximum combined dynamic ($C_p\gamma_w d_s$) and static ($1.2\gamma_w d_s$) wave pressures, also referred to as shock pressures in lb/ft^2 (kN/m^2)
F_t = net breaking wave force per unit length of structure, also referred to as shock, impulse, or wave impact force in lb/ft (kN/m), acting near the still water elevation
C_p = dynamic pressure coefficient ($1.6 < C_p < 3.5$) (see Table 5.4-1)

Table 5.4-1 Value of Dynamic Pressure Coefficient, C_p

Risk Category[a]	C_p
I	1.6
II	2.8
III	3.2
IV	3.5

[a]For Risk Category, see Table 1.5-1.

γ_w = unit weight of water, in lb per cubic ft (kN/m^3), = 62.4 pcf (9.80 kN/m^3) for fresh water and 64.0 pcf (10.05 kN/m^3) for salt water
d_s = still water depth in ft (m) at base of building or other structure where the wave breaks

This procedure assumes the vertical wall causes a reflected or standing wave against the waterward side of the wall with the crest of the wave at a height of $1.2d_s$ above the still water level. Thus, the dynamic static and total pressure distributions against the wall are as shown in Fig. 5.4-1.

This procedure also assumes the space behind the vertical wall is dry, with no fluid balancing the static component of the wave force on the outside of the wall. If free water exists behind the wall, a portion of the hydrostatic component of the wave pressure and force disappears (see Fig. 5.4-2) and the net force shall be computed by Eq. 5.4-7 (the maximum combined wave pressure is still computed with Eq. 5.4-5).

$$F_t = 1.1C_p\gamma_w d_s^2 + 1.9\gamma_w d_s^2 \qquad (5.4\text{-}7)$$

where

F_t = net breaking wave force per unit length of structure, also referred to as shock, impulse, or wave impact force in lb/ft (kN/m), acting near the still water elevation
C_p = dynamic pressure coefficient ($1.6 < C_p < 3.5$) (see Table 5.4-1)
γ_w = unit weight of water, in lb per cubic ft (kN/m^3), = 62.4 pcf (9.80 kN/m^3) for fresh water and 64.0 pcf (10.05 kN/m^3) for salt water
d_s = still water depth in ft (m) at base of building or other structure where the wave breaks

5.4.4.3 Breaking Wave Loads on Nonvertical Walls

Breaking wave forces given by Eqs. 5.4-6 and 5.4-7 shall be modified in instances where the walls or surfaces upon which the breaking waves act are