14.7 lb/in^2 (or psi). This pressure is pushing on all surfaces and in all directions all of the time. Water weighs 8.34 lb/gal, and there are 7.48 gal/ft^3 of water, so there are 62.4 lb of water per cubic foot. Thus 1 ft^3 of water in a container will exert 0.433 lb/in^2 pressure at the bottom of the container (62.4 lb/144 in^2 = 0.433 lb/in^2). If the container is filled to 2 ft deep, the pressure increases to 0.866 lb/in^2 ($2 \times 62.4 = 124.8$ lb, and 124.8 lb/144 in^2 = 0.866 lb/in^2). If a tube is placed in a container of water and a vacuum of 1 lb/in^2 is drawn on it, the water will rise on the tube 2.31 ft. So, for every foot of rise, the pressure of the water increases 0.433 lb/in^2. The pressure caused by the weight of the water is called the pressure head, or simply the head. Head is measured in feet; every foot of head is equal to 0.433 lb/in^2.

If a pond were to be designed with an above-grade wall, the design would have to address the pressure that would be exerted by the water in the filled pond. Pressure on the container wall will range from zero at the water surface to the depth of the water times 0.433 lb/in^2, or 62.4 lb/ft^2 (pounds per square foot). The formula for finding the force acting on the wall is:

$$F = 31.2 \times H^2 \times L$$

where F = the force acting on the wall, lb
H = head, ft
L = the length of the wall, ft

Note that 31.2 is the constant in pounds per cubic foot based on the force at the average depth exerted at $H/3$ from the bottom of the container.

Pumps are specified usually in terms of horsepower and head. The head a pump must overcome is called the *dynamic head,* which is measured as the vertical distance the pump must lift the water, the *static head* and the *friction loss* caused by the roughness of the pipe conveying the water. Charts for various types of pipes and fittings are provided by the manufacturers of those materials. For very short runs of pipes and fittings, friction loss may be nominal. The total dynamic head is the sum of the static head and friction losses.

$$\text{Water horsepower (hp)} = \frac{(\text{F, gal/min})\ (\text{H, ft})}{3960}$$

where hp = horsepower
F = flow, gal/min
H = lift, ft

Note that 3960 is derived from:

$$8.34\ \text{lb/gal} \times \frac{\text{hp}}{3000\ \text{ft-lb/in}} = 3960$$

Pumps, however, are unable to operate at perfect efficiency. More energy must be provided to the pump than is expressed as water horsepower. Motors