$$\left|\iint_D P\vec{n}dS\right| = \rho_s WLhg\sin\theta$$

I chose a coordinate system where n can be equal to the unit vector k, then I solve the double integral

$$\int_{y=0}^{h}\int_{x=0}^{W}\rho_l g(H-h-y\cos\theta)\vec{k}\,dx\,dy = W\left(\rho_l g(H-h)h - \frac{\rho_l gh^2\cos\theta}{2}\right)$$

Equate to the first expression I had

$$W\left(\rho_l g(H-h)h - \frac{\rho_l gh^2\cos\theta}{2}\right) = \rho_s WLhg\sin\theta$$

$$\rho_l g(H-h)h - \frac{\rho_l gh^2\cos\theta}{2} = \rho_s Lhg\sin\theta$$

$$\rho_l(H-h) - \frac{\rho_l h\cos\theta}{2} = \rho_s L\sin\theta$$

$$A = \rho_l(H-h)$$

$$B = \frac{\rho_l h}{2}$$

$$C = \rho_s L$$

$$A + B\frac{\sin 2\theta}{2\sin\theta} = C\sin\theta$$

$$A\sin\theta + \frac{B}{2}\sin 2\theta = C\sin^2\theta$$

$$2B\sin 2\theta = (C-A)\sin^2\theta$$