Appendix 3. Sludge Volume and Treatment Volume Worksheet

The average thickness of the sludge layer and the thickness of the existing liquid (sludge-free) treatment zone are determined from information on the Lagoon Sludge Survey Form (items O and P, respectively). **In the example provided, the average sludge layer thickness is 2.5 feet, and the existing liquid treatment zone is 3.5 feet.** If the lagoon has a designed sludge storage volume, see notes at end of the worksheet. The dimensions of the lagoon as measured and the side slope are needed for calculations of sludge volume and total treatment volume. If the lagoon is a standard geometric shape, the sludge volume and treatment volume in the lagoon can be estimated using standard equations. For approximate volumes of rectangular lagoons with constant side slope, calculate length and width at the midpoint of the layer, and multiply by layer thickness to calculate layer volume, as shown in the example. For irregular shapes, convert the total surface area to a square or rectangular shape. For exact volumes for lagoons with constant side slope, the "Prismoidal Equations" may be used.

		Example	Your Lagoon
1.	Average sludge layer thickness (T)	2.5 ft	
2.	Depth of lagoon from top of bank to bottom soil surface (D)	11 ft	
3.	Slope = horizontal/vertical side slope (S)	3	
4.	Length at top inside bank (L)	457 ft	
5.	Width at top inside bank (W)	229 ft	
6.	Length at midpoint of sludge layer (L_m): $L_m = L - 2 \times S \times (D - [T \div 2])$	398.5 ft.	
7.	Width at midpoint of sludge layer (W_m): $L_m = L - 2 \times S \times (D - [T \div 2])$	170.5 ft	
8.	Volume of sludge (V_s): $V_s = L_m \times W_m \times T$	169,860 cu ft	
9.	Volume in gallons (V_{sg}): $V_{sg} = V \times 7.5\ gal/ft$	1,273,950	
10.	Thickness of existing liquid treatment zone (Y)	3.5 ft	
11.	Thickness of total treatment zone (Z): $Z = T + Y$	6.0 ft	
12.	Length at midpoint of total treatment zone (L_z): $L_z = L - 2 \times S \times (D - [Z \div 2])$	409 ft	
13.	Width at midpoint of total treatment zone (W_z): $W_z = W - 2 \times S \times (D - [Z \div 2])$	181 ft	
14.	Volume of total treatment zone (V_z): $V_z = L_z \times W_z \times Z$	444,174 cu ft	
15.	Ratio (R) of sludge layer volume to total treatment volume:	0.38	
16.	If the ratio exceeds 0.50, then a sludge Plan of Action (POA) may be required. Check with DEQ for information on filing the POA.		

Note: If the lagoon has a designed sludge storage volume (DSSV), subtract that volume from both the volume of sludge (V_s) (Item 8) and from the volume of total treatment zone (V_z) (Item 14), and calculate the ratio:

$$V_{sg} = V \times 7.5\ gal/ft$$

Example: If DSSV = 85,000 cu ft, then

$$R = (169,860 - 85,000) \div (444,174 - 85,000)$$

$$R = 84,860 \div 359,174 = 0.24$$