Appendix 1. Lagoon Sludge Survey Form   **Revised August 2008**

A. Farm Permit or DWQ Identification Number_____

B. Lagoon Identification _____

C. Person(s) Taking Measurements _____

D. Date of Measurements _____

E. Methods/Devices Used for Measurement of:

        a. Distance from the lagoon liquid surface to the top of the sludge layer:
        _____

        b. Distance from the lagoon liquid surface to the bottom (soil) of the lagoon:
        _____

        c. Thickness of the sludge layer if making a direct measurement with "core sampler":
        _____

F. Lagoon Surface Area (using dimensions at inside top of bank): _____(acres)
     (Draw a sketch of the lagoon on a separate sheet, list dimensions, and calculate surface area. **The lagoon may have been built different than designed, so measurements should be made.**)

G. Estimate number of sampling points:
        a. Less than 1.33 acres: Use 8 points
        b. If more than 1.33 acres, _____ acres x 6 = _____, with maximum of 24.
        (Using sketch and dimensions, develop a uniform grid that has the same number of intersections as the estimated number of sampling points needed. Number the intersection points on the lagoon grid so that data recorded at each can be easily matched.)

H. Conduct sludge survey and record data on "Sludge Survey Data Sheet" (Appendix 2). **Also, at the location of the pump intake, take measurement of distance from liquid surface to top of sludge layer and record it on the Data Sheet (last row); this must be at least 2.5 ft. when irrigating.**

I. At the time of the sludge survey, also measure the distance from the Maximum Liquid Level to the Present Liquid Level (measure at the lagoon gauge pole): _____

J. Determine the distance from the top of bank to the Maximum Liquid Level _____
     (use lagoon management plan or other lagoon records)

K. Determine the distance from the Maximum Liquid Level to the Minimum Liquid Level _____
     (use lagoon management plan or other lagoon records)

L.   Calculate the distance from the present liquid surface level to the Minimum Liquid Level _____
     (**Item K minus Item I**, assuming the present liquid level is below the Maximum Liquid Level):

M. Record from the Sludge Survey Data Sheet the distance from the present liquid surface level to the lagoon bottom (average for all the measurement points): _____

N. Record from the Sludge Survey Data Sheet the distance from the present liquid surface level to the top of the sludge layer (average for all the measurement points): _____

O. Record from the Sludge Survey Data Sheet the average thickness of the sludge layer: _____

P. Calculate the thickness of the existing Liquid Treatment Zone (**Item N minus Item L**): _____

Q. **If Item O is greater than Item P, proceed to the Worksheet for Sludge Volume and Treatment Volume. If Item O is equal to or less than Item P, you do not have to determine volumes.**

Completed by: _____ _____Date:_____
            Print Name   Signature

Appendix 2. Sludge Survey Data Sheet*   **Revised August 2008**

Lagoon Identification: _____

Completed by: _____ _____ Date:_____
               Print Name   Signature

(A)	(B)		(C)		(C) minus (B)	
Grid Point No.	Distance from liquid surface to top of sludge		Distance from liquid surface to lagoon bottom (soil)		Thickness of sludge layer	
	Ft. & in.	Ft.(tenths)	Ft. & in.	Ft. (tenths)	Ft. & in.	Ft. (tenths)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
Number of points with readings		X		X		
Average of points						
At pump intake		X	X	X	X	

*All Grid Points and corresponding sludge layer thicknesses must be shown on a sketch attached to this Sludge Survey Data Sheet.   See Appendix 4 for conversion from inches to tenths of a foot.

Appendix 3. Worksheet for sludge volume and treatment volume   Revised August 2008

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 this example, 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 of total treatment volume. If the lagoon is a standard geometric shape, the sludge volume and treatment volume in the lagoon can be estimated by 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 $L_m = L - 2 S (D - (T/2))$	398.5 ft.	_____
7.	Width at midpoint of sludge layer $W_m = W - 2 S (D - (T/2))$	170.5 ft.	_____
8.	Volume of sludge (Vs): $Vs = L_m W_m T$	169,860 ft^3	_____
9.	Volume in gallons: $Vs_g = V * 7.5$ gal./ft^3.	1,273,950 gal.	_____
10.	Thickness of existing liquid tmt. Zone (Y)	3.5 ft.	_____
11.	Thickness of total treatment zone (Z) $Z = T + Y$	6.0 ft.	_____

Appendix 3. Worksheet for sludge volume and treatment volume (continued)

12. Length at midpoint of total tmt. zone   ____409 ft.____ _____
    $Lz = L - 2(S)(D - (Z/2))$

13. Width at midpoint of total tmt. zone   ____181 ft.____ _____
    $Wz = W - 2(S)(D - (Z/2))$

14. Volume of total treatment zone (Vz)   ____444,174 ft^3____ _____
    $Vz = Lz\ Wz\ Z$

15. Ratio (R) of sludge layer volume to total
    Treatment volume
    $R = Vs/Vz$ ____0.38____ _____

If the ratio exceeds 0.50, than a sludge Plan of Action may be required. Check with DWQ for information on filing the Plan of Action.

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

$$R = (Vs - DSSV) / (Vz - DSSV)$$

Example: If DSSV = 85,000 ft^3, then R = (169,860 – 85,000) / (444,174 – 85,000)

$$R = 84,860 / 359,174 = 0.24$$

Appendix 4. Conversion table from inches to tenths of a foot.

Inches	Tenths of foot	Inches	Tenths of foot
1	0.1	7	0.6
2	0.2	8	0.7
3	0.2	9	0.7
4	0.3	10	0.8
5	0.4	11	0.9
6	0.5		