

## APPENDIX A

### State Design Criteria for Wastewater Ponds

**APPENDIX A  
STATE DESIGN CRITERIA FOR WASTEWATER STABILIZATION PONDS**

Table A-1 Minimum Hydraulic Residence Time and Depth Requirements

State	Minimum Hydraulic Residence Time (HRT)			Depth Requirements			
	Controlled Discharge and Non-discharge	Facultative Flow-Through days	Aerated days	Facultative Cell ft	Controlled Discharge ft	Aerated Cell ft	Anaerobic Cell
Alabama							
Alaska	Each design evaluated on a case-by-case basis.						
Arizona	Stabilization alone does not meet state water quality requirements for sewage treatment facility. New facilities must meet "Best Available Demonstrated Control Technology" treatment standards. Exceptions require demonstrations unique site-specific characteristics and environmental factors. Economic hardship is not a listed criterion for exception to BADCT.						
Arkansas	Ten State	Second cell of two cell system two cell system must be designed at same loading rate as primary with min HRT of 30 days. Cells following primary of 3 or more cells will have combined HRT of 30 days. Final cell designed for settling.	t = HRT, d E = % BOD <sub>5</sub> removed k <sub>1</sub> = reaction rate, d <sup>-1</sup> k <sub>T</sub> = 0.12/d at 20 °C k <sub>T</sub> = 0.06/d at 1 °C	Ten State	Ten State	Ten State	NA
California	All criteria controlled by Regional Board						
Colorado	NA	180	12-30 Polishing Pond 2-5 at avg flow	5	NA	8-20 Polishing pond 8-12 but as great as practical.	NA
Connecticut	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table
Delaware							
Florida	Case by Case Analysis						
Georgia	Ten State	Ten State	Ten State	Ten State	Ten State	Ten State	NA

State	Minimum Hydraulic Residence Time (HRT)			Depth Requirements			
	Controlled Discharge and Non-discharge	Facultative Flow-Through days	Aerated days	Facultative Cell ft	Controlled Discharge ft	Aerated Cell ft	Anaerobic Cell
Hawaii							
Idaho	Must be considered with regard to environmental conditions.	Must be considered with regard to environmental conditions.	Must be considered with regard to environmental conditions.	Must be considered with regard to environmental conditions. Minimum operating depth is 2 ft.	Must be considered with regard to environmental conditions. Minimum operating depth is 2 ft.	Must be considered with regard to environmental conditions. Minimum operating depth is 2 ft.	Must be considered with regard to environmental conditions. Minimum operating depth is 2 ft.
Illinois	Ten State	Ten State	Ten State	Not less than 5 Min Operating 2	10 State	10-15	NA
Indiana	90	90	Ten State	5	5	Ten State	NA
Iowa	180 Design to be based on wettest 180 consecutive days	Not acceptable for secondary treatment	Partial Mix 180 Design to be based on wettest 30 consecutive days	Not acceptable for secondary treatment	Primary Cells Max 6 Secondary Max 8		NA
Kansas							
Kentucky	Ten State	Primary cell must have minimum hydraulic residence time of 90 days	Ten State Also based on organic loading rate of 150 lbs per acre-day	Ten State	Ten State	Ten State	NA
Louisiana							
Maine	Based on storage required.	Design standards in TR-16, Ten State Standards or other published literature accepted by DEP or EPA are to be considered. Recirculation required.	Design standards in TR-16, Ten State Standards or other published literature accepted by DEP or EPA are to be considered. Recirculation required.	Design standards in TR-16, Ten State Standards or other published literature accepted by DEP or EPA are to be considered. Recirculation required.	Design standards in TR-16, Ten State Standards or other published literature accepted by DEP or EPA are to be considered. Recirculation required.	Partial Mix Minimum 10 ft	Design standards in TR-16, Ten State Standards or other published literature accepted by DEP or EPA are to be considered. Recirculation required.
Maryland	NA	60	30	Minimum 3 ft Maximum 5 ft	NA	15	NA

State	Minimum Hydraulic Residence Time (HRT)			Depth Requirements			
	Controlled Discharge and Non-discharge	Facultative Flow-Through days	Aerated days	Facultative Cell ft	Controlled Discharge ft	Aerated Cell ft	Anaerobic Cell
Massachusetts	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table
Michigan	Ten State	Ten State	Ten State	Ten State	Ten State	Ten State	NA
Minnesota 54 pg document with details for all aspects of lagoon systems.	Ten State	180-210 180 d between two and a max. depth of 6 feet	Varies with design $t = \frac{E}{2.3k_1(100-E)}$ Eq. used for each cell. Total HRT must equal min of 25 d to meet BOD of 25 mg/L. Total HRT must equal min of 35 d to meet BOD of 15 mg/L. t = HRT, d E = % BOD <sub>5</sub> removed k <sub>1</sub> = reaction rate, d <sup>-1</sup> k <sub>T</sub> = 0.12/d at 20 °C k <sub>T</sub> = 0.06/d at 0.5 °C	Max 6	NA	10-15	NA
Mississippi	Hydrograph controlled release minimum storage 90 days	30 days at 4 ft. operating depth.	Partial Mix 18 days plus settling area of 1 day. Complete Mix not specified.	6	15 Max for storage cell 20	10-15	20 Day HRT 8-20 Water Depth
Missouri							
Montana	Primary 40-80 Based on volume between 2 ft and maximum depth. Secondary Based on volume between 1 ft and maximum depth.	Primary 40-80 Based on volume between 2 ft and maximum depth. Secondary Based on volume between 1 ft and maximum depth.	Partial Mix Min 20 days under aeration  t = HRT, d E = % BOD <sub>5</sub> removed k <sub>1</sub> = reaction rate, d <sup>-1</sup> k <sub>T</sub> = 0.12/d at 20 °C	Secondary Cells 8	Secondary Cells 8	10-15	NA

State	Minimum Hydraulic Residence Time (HRT)			Depth Requirements			
	Controlled Discharge and Non-discharge	Facultative Flow-Through days	Aerated days	Facultative Cell ft	Controlled Discharge ft	Aerated Cell ft	Anaerobic Cell
Nebraska	Discharge limited to once or twice per year. Half or all of average flow must be stored.	Primary cells must have minimum HRT of 60 days and entire volume must have a minimum of HRT of 120 days. Area of initial cell should not be greater than approx. 2/3 of the total area.	$k_T = 0.06/d$ at 0 °C  Partial Mix BOD removal 30-60 Ammonia-N 80-90 TKN 100-120 Complete Mix 1.5 to 2.0 for 85% BOD removal. HRT of 7 to 10 for complete nitrification.	Primary 4-6 Final cells max. 8.	NA	Partial Mix 7-14 Complete Mix 10-20	As deep as possible. Not less than 10-15 ft.
Nevada	NA	$\frac{C_e}{C_0} = e^{-k_p t}$ t = HRT $k_p = k_{p20}(1.09)^{(T-20)}$ e = base natural log C <sub>e</sub> = eff BOD C <sub>0</sub> = inf BOD k <sub>p20</sub> = varies with load 0.045 to 0.096 d <sup>-1</sup>	$\frac{C_e}{C_0} = \frac{1}{\left[1 + \left(\frac{k_{pMT} t}{n}\right)^n\right]}$ t = HRT $k_{pMT} = k_{pM20}(1.036)^{(T-20)}$ C <sub>e</sub> = eff BOD C <sub>0</sub> = inf BOD n = no. cells in series Same equation for partial mix and complete mix. k <sub>pM20</sub> = 0.276 d <sup>-1</sup> k <sub>CM20</sub> = 2.5 d <sup>-1</sup>	4-10	NA	6-20	NA
New Hampshire	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table
New Jersey	Each design evaluated on a case-by-case basis.						
New Mexico							
New York	Ten State and TR-16	Ten State and TR-16	Ten State and TR-16	Ten State and TR-16	Ten State and TR-16	10 State and TR-16	NA
North Carolina							
North Dakota	NA	Primary Cells 180 One-half of total	Can be reduced from 180 days with addition of	5 Min operating 2	NA	NA	NA

State	Minimum Hydraulic Residence Time (HRT)			Depth Requirements			
	Controlled Discharge and Non-discharge	Facultative Flow-Through days	Aerated days	Facultative Cell ft	Controlled Discharge ft	Aerated Cell ft	Anaerobic Cell
Ohio	Based on calculated loading rates. Ten States	surface area. 180 days based on total hydraulic loading.	aeration.	Max. 7 Min. Operating 1.5	Max. 7 Min. Operating 1.5	Ten State	NA
Oklahoma		Based on calculated loading rates. Ten States					
Oregon	NA	NA	NA	3 to 5	NA	8-10	NA
Pennsylvania	90 days between 2 foot and max. operating depth. Mean operating depth is max. operating depth plus minimum divided by two.	90-120	$t = \frac{E}{2.3k_1(100 - E)}$ t = HRT, d E = % BOD <sub>5</sub> removed k <sub>1</sub> = reaction rate, d <sup>-1</sup> k <sub>T</sub> = 0.20/d at 20 °C k <sub>T</sub> = 0.06/d at 0 °C	Primary cells 6 Secondary ponds depth 8 ft.	Primary cells 6	10-15	NA
Rhode Island	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table
South Carolina	No Specific Criteria.	Evaluated on a case by case.					
South Dakota	Surface Area for total retention, A=I/WL. Summr or yr around, A = I/(H+WL) Winter months,	Primary Cell should be approx. 50-60% of total surface area. 180 d between two and a max. depth of 5 feet.	$t = \frac{E}{2.3k_1(100 - E)}$ t = HRT, d E = % BOD <sub>5</sub> removed k <sub>1</sub> = reaction rate, d <sup>-1</sup>	5	5	Max. 20 Min. 10	NA

State	Minimum Hydraulic Residence Time (HRT)			Depth Requirements			
	Controlled Discharge and Non-discharge	Facultative Flow-Through days	Aerated days	Facultative Cell ft	Controlled Discharge ft	Aerated Cell ft	Anaerobic Cell
Tennessee	<p>A = I/(H+S-P)                      A = surface area, ac                      I = inflow, ac-ft                      WL = net H<sub>2</sub>O loss                      S = seepage, ft                      H = depth &gt; 2 ft                      P = precip., ft</p> <p>NA</p>	<p>First secondary cell max depth is 6. Other following cells may have depth 8.</p> <p>Not specified.</p>	<p><math>k_T = 0.20/d</math> at 20 °C  <math>k_T = 0.08/d</math> at 0 °C  <math>k_1 = k_{T20}(1.47)^{(T-20)}</math>                      t = 5-10 d Warm                      t = 8-20 d Cold                      Settling Pond 5-7</p> $\frac{C_e}{C_0} = \frac{1}{1 + 2.3(k_1 t)}$ <p>t = HRT, d                      C<sub>e</sub> = eff BOD<sub>5</sub>, mg/L                      C<sub>0</sub> = inf BOD<sub>5</sub>, mg/L                      k<sub>1</sub> = reaction rate, d<sup>-1</sup>                      k<sub>1</sub> = 1.097 @ 20 °C for complete mix.                      k<sub>1</sub> = 0.12 @ 20 °C for partial mix.  <math>k_T = k_{20}(1.036)^{(T-20)}</math></p>	<p>Primary 6                      Greater depths considered for polishing and last ponds in series.</p>	NA	Not less than 7	NA
Texas	<p>NA</p>	<p>Based on organic loading rate</p>	<p>HRT in combined aerated lagoon and secondary pond system shall be a minimum of 21 days. Secondary ponds BOD<sub>5</sub> removal calculated by</p> $E = \frac{1}{1 + K(V/Q)}$ <p>Where: E = efficiency of CM without recycle.                      K = removal rate constant                      K = 0.5 day<sup>-1</sup>                      V = volume, MG                      Q = flow rate, mgd                      Applies to Partial Mix and complete aerated cells.</p>	<p>Approx. 25 % of Inlet portion shall have a 10-12 ft depth for sludge storage and anaerobic treatment. Remainder of pond 5 to 8 ft.</p>	NA	Secondary aerated ponds 3-5 ft	NA
Utah	<p>NA</p>	<p>Exclusive of sludge build-up, 120 on winter flow at max operating depth, or 60 on summer flow and peak month I/I. HRT shall not be less than 150 at mean operating depth without chlorination. To meet bact. standards, at least 5 cells required.</p>	$E = \frac{1}{[1 + (2.3k_1 t)]}$ <p>E = frac BOD<sub>5</sub> remaining                      t = HRT, d                      k<sub>1</sub> = reaction rate, d<sup>-1</sup>                      k<sub>1</sub> = 0.12/d @ 20 °C                      k<sub>1</sub> = 0.06/d @ 1 °C                      30 minimum</p>	<p>Primary 6                      Greater depth if aeration or mixing is incorporated.                      Min operating depth 3                      Min of 18 in for sludge.</p>	NA	10-15	NA
Vermont	<p>TR-16                      See end of table</p>	<p>TR-16                      See end of table</p>	<p>TR-16                      See end of table</p>	<p>TR-16                      See end of table</p>	<p>TR-16                      See end of table</p>	<p>TR-16                      See end of table</p>	<p>TR-16                      See end of table</p>

State	Minimum Hydraulic Residence Time (HRT)			Depth Requirements			
	Controlled Discharge and Non-discharge	Facultative Flow-Through days	Aerated days	Facultative Cell ft	Controlled Discharge ft	Aerated Cell ft	Anaerobic Cell
Virginia	NA	45 based on 4-ft operational level. Sludge storage based 20-year design life.	NA	Min operating depth 2 Max operating depth 5 excluding sludge storage.	NA	NA	NA
Washington	NA	NA	NA	NA	NA	NA	NA
West Virginia							
Wisconsin	Ten State	150	$t = \frac{E}{K(100 - E)}$ t = HRT E = BOD removal, % K = reaction coef. Base e K = 0.5 at 20 °C K <sub>T</sub> = K <sub>20</sub> (1.07) <sup>(T-20)</sup> Min settling = 6	Max 6 Min Operating 2	Ten State	15 Minimum Operating 6	NA
Wyoming	NA	180	Primary Cell Complete Mix Not < 1.5 Partial Mix Not < 7 Secondary cells shall increase overall HRT to 30	6	NA	4-15	NA
Ten-State Standards 1997 Edition	At least 180 d between 2' depth and max depth	90-120	$t = \frac{E}{2.3k_1(100 - E)}$ t = HRT, d E = % BOD <sub>s</sub> removed k <sub>1</sub> = reaction rate, d <sup>-1</sup> k <sub>T</sub> = 0.12/d at 20 °C k <sub>T</sub> = 0.06/d at 1 °C	Max 6' Primary Min 2' Greater Depths allowed in subsequent cells	Max 6' Primary Min 2' Greater Depths allowed in subsequent cells	10-15	NA
TR-16 Guides for Design of Wastewater Treatment Works 1998 Edition	180 Between 2-foot and maximum operating depth.	90-120	<b>Partial Mix</b> $t = \frac{E}{k_e(100 - E)}$ t = HRT, d E = % BOD removed k <sub>e</sub> = reaction rate, base e, d <sup>-1</sup> k <sub>T</sub> = 0.28/d at 20 °C k <sub>T</sub> = 0.14/d at 10 °C For three cell facility suggested	3 ft minimum operating depth. 5 ft maximum	3 ft minimum operating depth. 5 ft maximum	<b>Partial Mix</b> 10-20	NA



State	Minimum Hydraulic Residence Time (HRT)			Depth Requirements			
	Controlled Discharge and Non-discharge	Facultative Flow-Through days	Aerated days	Facultative Cell ft	Controlled Discharge ft	Aerated Cell ft	Anaerobic Cell
			$k_d$ at 10°C First cell - 0.14 Second cell - 0.06 Third cell - 0.02 <b>Complete Mix</b> 7-20				

Table A-2. Sealing, Point of Discharge, N-Removed, P. Removal, Drawoff, Multi-level Required, Comments

State	Pond Bottom Sealing	Point of Discharge		Nitrogen Removal Required	Phosphorus Removal Required	Multi-level Drawoff Required	Comments
		Primary	Aerated				
Alabama							
Alaska							
Arizona							
Arkansas	Ten State	Ten State	Ten State	Ten State	Ten State	NA	
California							
Colorado	Required seepage must not exceed 1/32 in/d. If not obtained in natural soil, must use native clays, soil cement, asphalt or synthetic liners.	NA	NA	Where applicable	No	Required	

Table A-2 (cont)

State	Pond Bottom Sealing	Point of Discharge		Nitrogen Removal Required	Phosphorus Removal Required	Multi-level Drawoff Required	Comments
		Primary	Aerated				
Connecticut	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table
Delaware							
Florida							
Georgia	Ten State	Ten State	Ten State	Ten State	NA	Ten State	
Hawaii							
Idaho	Required Maximum seepage rate must not exceed 500 gallons per acre per day. Sensitive aquifers or near TMDL streams may require considerably lower seepage rate. After 4/15/07, rate shall be no more than 0.125 inches/day. Testing required after five years of operation.	NA	NA	Where applicable	Where applicable	NA	Controlled discharge lagoons allowed.
Minnesota 54 pg document with details for all aspects of lagoon systems.	Required	Primary Cells Influent Line terminates at midpoint of width and approx. 2/3 length from outlet	Multiple inlets required	Ten State	NA	Required	
Mississippi	Required Water loss shall not exceed 500 gpd/ac at head equal to max operating depth.	Primary cells terminate near center of cell.	Distribute flow and load in mixing zone.	NA	NA	Recommended	

Table A-2 (cont)

State	Pond Bottom Sealing	Point of Discharge		Nitrogen Removal Required	Phosphorus Removal Required	Multi-level Drawoff Required	Comments
		Primary	Aerated				
Missouri							
Montana	Required Max seepage 6 in/year	Midpoint of width, at approx. 10 ft from toe of dike and as far as possible from outlet structure.	Distribute load within mixing zone.	NA	NA	Must Consider	Total Retention Ponds 1 primary, 15-35 lbs/ac-d, max depth 6 ft, t = 40-80 d, 1 secondary, max depth 8 ft,
Nebraska	Required Maximum seepage rate must not exceed 1/8 in./d	Inlets to regular shaped cells terminate at center of cell. Rectangular cells inlets terminate at approx. one-third the length from upstream end of cell. Cells without outlet discharge at center of cell. Multiple inlets should be considered for large cells.	NA	See HRT	NA	Recommended	Complete retention lagoons allowed. A minimum of two cells must be provided with at least one pond having capacity to assure adequate depth. Lemna ponds considered for final pond.
Nevada	Required	Multiple inlets and outlets recommended	Multiple inlets and outlets recommended	Where applicable	NA	Recommended	

Table A-2 (cont)

State	Pond Bottom Sealing	Point of Discharge		Nitrogen Removal Required	Phosphorus Removal Required	Multi-level Drawoff Required	Comments
		Primary	Aerated				
New Hampshire	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table
New Jersey							
New Mexico							
New York	Required	Multiple inlets and outlets encouraged	Multiple inlets and outlets encouraged	NA	NA	Multiple outlets encouraged	Hydrograph control release lagoons permissible
North Carolina							
North Dakota	Required compacted clay, bentonite, or other approved material.	Primary Cells Essentially center of cell.	NA	NA	NA	NA	L:W, 3:1 Facultative

Table A-2 (cont)

State	Pond Bottom Sealing	Point of Discharge		Nitrogen Removal Required	Phosphorus Removal Required	Multi-level Drawoff Required	Comments
		Primary	Aerated				
Ohio	Ten State	Ten State	Ten State	Ten State	Ten State	Required	
Oklahoma							
Oregon	Average seepage rate less than 1/8 per day, corrected for evaporation and precipitation.	Primary cells inlets located near center of lagoon. Secondary cells inlets located at or near shoreline.	NA	NA	NA	Outlet provide for surface or subsurface withdrawals Surface skimming baffles shall be provided ahead of surface overflow structures.	Aerobic ponds 12 to 18 in. deep. Algae production main function.
Pennsylvania	Required On-site soils, bentonite, or other synthetic liners. Coefficient of permeability of sides and bottom will not exceed $1 \times 10^7$ centimeters per second. Flexible membrane liners shall have a minimum thickness of 0.030 in.	At mid-point of width and at approximately two-thirds of length away from outlet structure. Multi-influent discharge points for primary cells 20 acres or larger	Distribute load within mixing zone.			Recommended for deep ponds where stratification may occur. A minimum of three discharge points are required.	Rectangular ponds with L:W 3:1 most desirable.
Rhode Island	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table
South Carolina							
South Dakota	Required Seepage rate for primary cell shall not exceed 1/16 in/d. Allowable seepage 1/8 in/d for cells in series following	Influent line should terminate at approx. 1/3 of length upstream end of cell. At approx. mid-point in cells without outlet.	To active mixing	NA	NA	Recomended	

Table A-2 (cont)

State	Pond Bottom Sealing	Point of Discharge		Nitrogen Removal Required	Phosphorus Removal Required	Multi-level Drawoff Required	Comments
		Primary	Aerated				
Tennessee	primary.  Required Earth liners, bentonite, synthetic membrane liners. Seepage rate shall not be greater than 1/4 in/d.	NA	NA	NA	NA	Multiple inlets for ponds larger than 10 ac.	Hydrograph controlled release lagoons allowed. Recirculation should be considered.
Texas	Required Clay soils meeting certain specifications are allowable. Membrane lining minimum thickness 20 mils	NA	NA	NA	NA	Required multiple inlets and outlets with baffling.	L:W of ponds 3:1 or 4:1
Utah	Required Earth liners, bentonite, synthetic membrane liners. Seepage rate shall not be greater than $1.0 \times 10^6$ cm/sec.	In center of round or square cell or at third point farthest from outlet structure in rectangular cell.	At point where load is distributed within mixing zone. Multiple inlets considered in diffused air system.	NA	NA	Multiple inlets to primary cell of 20 ac	Total containment lagoons allowed. Same requirements for facultative apply with exception of discharge.

Table A-2 (cont)

State	Pond Bottom Sealing	Point of Discharge		Nitrogen Removal Required	Phosphorus Removal Required	Multi-level Drawoff Required	Comments
		Primary	Aerated				
Vermont	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table	TR-16 See end of table
Virginia	Required Natural soil, enhanced soil (bentonite, cement, etc., synthetic materials. Seepage rate <3 cm/yr.	Round or square ponds acceptable, but rectangular with L:W up to 10:1 most desirable. Influent and effluent shall be located as far apart as possible along flow path.	NA	NA	NA	Withdrawal points located at 0.75 ft to 2 ft below water irrespective of pond depth. Lowest draw-off shall be 12 in. off bottom.	
Washington	Required Double liner with leak detection required, and single liner with leak detection required.	NA	NA	Aeration must be provided for nitrification.	NA	NA	Total containment lagoons allowed. Design case is "wet" year (1 year in 10 recurrence interval).
West Virginia							
Wisconsin	Required Natural soil, enhanced soil (bentonite, cement, etc.,) synthetic materials. Seepage rate 1000 gal/ac-d	Round, square or rectangular allowed. Length not to exceed 3 times width. Circular lagoons discharge to center. Rectangular or square discharge to first one third of lagoon length.	NA	NA	NA	Required Multi-valved drawoff lines.	



Table A-2 (cont)

State	Pond Bottom Sealing	Point of Discharge		Nitrogen Removal Required	Phosphorus Removal Required	Multi-level Drawoff Required	Comments
		Primary	Aerated				
Wyoming	Must guarantee no threat to groundwater. Permeability of $10^{-7}$ cm/sec or less required without guarantee.	Fac Primary Cell Inlet shall terminate from outlet at least equal to greater than 2/3 the longest dimension.	Aerated inlet shall terminate in mixing zone.	Facultative t = 180 days Aerated t = 160 days	Chemical treatment required.	Required in final cell. At least one located at two-foot level.	Total containment lagoons allowed. BOD <sub>5</sub> loading shall not exceed 14 lb/ac-d. Rectangular cells shall have a maximum L:W of 5:1.
Ten-State Standards 1997 Edition	Required soils, bentonite or synthetic liners	Primary Cells Influent line terminates at midpoint of width and approx. 2/3 length from outlet.	Distribute load within mixing zone.	NA	NA	NA	NA
TR-16 Guides for Design of Wastewater Treatment Works 1998 Edition	Required Soils, bentonite or Synthetic Liners Leakage should be less than 500 gpd/ac. Sealed so that seepage loss is as low as possible.	NA	Distribute load within mixing zone.	NA	NA	Should be provided. In deeper ponds minimum of three withdrawal pipes at different elevations should be installed.	Screening and/or comminution should precede wastewater treatment ponds. Hydrograph release allowed. Treated effluent should be recirculated to primary cell. Anaerobic lagoons typical HRT 20-50 days.