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STORAGE TANKS FOR LIVESTOCK WATER SYSTEMS

This Factsheet has information and capacities on storage tanks for livestock water use. Examples are given.

Use of Tanks

Besides storage in dugouts or lakes, water may be stored in tanks. Wood, concrete, steel and polyethylene are some common tank materials. If required, vinyl liners can be custom made to waterproof most any shape of tank. Tanks may be open topped for low cost but water quality can be improved and evaporation reduced with a top or roof. Water storage will normally be less expensive in a pond or lake than in a tank, but tanks will be required if:

- the soil is not suited for a pond i.e. too sandy or too rocky
- the water loss due to evaporation from a pond is not acceptable due to limited water supply
- the storage is short term and will be relocated
- the water quality is important

Types of Tanks. While various materials can be used, the shape and size of the tank will limit material choice. Round tanks are inherently stronger than flat sided tanks. For the same water storage, shallow tanks will have a larger surface area and be harder to roof than deep tanks. For example if a low cost plywood tank was to be constructed, the design would be limited to a shallow depth (because of its flat sides) and a low volume.

However if a round tank was selected a large volume of water can be economically stored. Round stave tanks of wood or concrete are likely to be too expensive for storing livestock water. Polyethylene tanks may be used if the tank must be moved often but are expensive; approximately $1.50 per stored gallon

A low cost-per-gallon storage tank can be constructed using corrugated, galvanized steel grain bins set on a sand covered earth bottom and lined with a 20 mil vinyl liner. The bin roof ensures good water quality and controls evaporation. Because the bin will have a heavier load with water than the design load with grain, caution must be used. Consult professional advise before converting grain bins for water storage.

Installation. Unless special pressure rated tanks are used, tanks must be installed so the water line pressure cannot build up in the tank. This can be done either by using a float valve on the tank inlet to shut off the supply or by using a free flowing tank overflow outlet pipe.

Tank Capacities

The following three tables give tank capacities of cylindrical and rectangular tanks with formulas to calculate capacities of tanks of other sizes.

Cylindrical Tanks. The following are capacities of cylindrical tanks when the inside diameter and depth of water is known. Table 1 gives capacity of vertical tanks (round end on the ground) and Table 2 gives percent capacity of horizontal tanks.

TABLE 1 CAPACITIES OF *VERTICAL* CYLINDRICAL TANKS *

inside diameter (ft-in)	capacity per inch of water (USgal)	inside diameter (ft-in)	capacity per inch of water (USgal)	inside diameter (ft-in)	capacity per inch of water (USgal)
3'-0"	4.41	9'-0"	39.66	15'-0"	110.16
3'-6"	6.00	9'-6"	44.19	15'-6"	117.63
4'-0"	7.83	10'-0"	48.96	16'-0"	125.34
4'-6"	9.91	10'-6"	53.98	16'-6"	133.29
5'-0"	12.24	11'-0"	59.24	17'-0"	141.49
5'-6"	14.81	11'-6"	64.75	17'-6"	149.94
6'-0"	17.63	12'-0"	70.50	18'-0"	158.63
6'-6"	20.69	12'-6"	76.50	18'-6"	167.57
7'-0"	23.99	13'-0"	82.74	19'-0"	176.75
7'-6"	27.54	13'-6"	89.23	19'-6"	186.17
8'-0"	31.33	14'-0"	95.96	20'-0"	195.84
8'-6"	35.37	14'-6"	102.94	20'-6"	205.75

* for other cylindrical tank sizes: Capacity (USgal) = Diameter (ft) x Diameter (ft) x Depth (ft) x 5.875

Horizontal Cylindrical Tanks - Full. The capacity of a **full** cylindrical tank is the same whether the tank sits vertical or horizontal:

Cylindrical Capacity (USgal) = Diameter (ft) x Diameter (ft) x Depth (ft) x 5.875

Horizontal Cylindrical Tanks - Partially Full. The capacity of a **partially full horizontal** cylindrical tank is:

Partially Full Cylindrical Capacity (USgal) = Percent Capacity x Full Capacity

find Percent Capacity from Table 2: calculate Depth Ratio **D** (water depth ÷ tank diameter); then locate Value for Percent Capacity in the Table

TABLE 2 PERCENT CAPACITY OF *HORIZONTAL* CYLINDRICAL TANKS

D	% capacity	D	% capacity	D	% capacity	D	% capacity
.02	.48	.28	22.92	.54	55.09	.80	85.77
.04	1.35	.30	25.23	.56	57.63	.82	87.76
.06	2.45	.32	27.57	.58	60.15	.84	89.68
.08	3.75	.34	29.98	.60	62.65	.86	91.49
.10	5.20	.36	32.41	.62	65.13	.88	93.20
.12	6.80	.38	34.87	.64	67.59	.90	94.80
.14	8.51	.40	37.35	.66	70.02	.92	96.25
.16	10.32	.42	39.85	.68	72.43	.94	97.55
.18	12.24	.44	42.37	.70	74.77	.96	98.65
.20	14.23	.46	44.91	.72	77.08	.98	99.52
.22	16.31	.48	46.46	.74	79.35	1.00	100.00
.24	18.45	.50	50.00	.76	81.53		
.26	20.65	.52	52.54	.78	83.69		

Rectangular Tanks. Table 3, below, gives the capacity of rectangular tanks (per inch of depth) when the inside length and width of the tank is known.

TABLE 3 **CAPACITIES OF RECTANGULAR TANKS ***

Capacity per Inch of Depth (USgal)										
Length (ft)	**Width (ft)**									
	4	**5**	**6**	**7**	**8**	**9**	**10**	**12**	**14**	**16**
4	10.0									
5	12.5	15.6								
6	15.0	18.7	22.4							
7	17.5	21.8	26.2	30.5						
8	20.0	24.9	29.9	34.9	39.9					
9	22.4	28.1	33.7	39.3	44.9	50.5				
10	24.9	31.2	37.4	43.6	49.9	56.1	62.3			
12	29.9	37.4	44.9	52.4	59.8	67.3	74.8	89.8		
14	34.9	43.6	52.4	61.1	69.8	78.6	87.3	104.7	122.2	
16	39.9	49.9	59.8	69.8	79.8	89.8	99.7	119.7	139.6	159.6
18	44.9	56.1	67.3	78.6	89.8	101.0	112.2	134.7	157.1	179.5
20	49.9	62.3	74.8	87.3	99.7	112.2	124.7	149.6	174.6	199.5

* for other rectangular tank sizes: Capacity (USgal) = Length (ft) x Width (ft) x Depth (ft) x 7.4805

Example – Vertical Cylindrical Tank

A cylindrical tank is 10 feet in diameter by12 feet long with 8 feet 6 inches of water in it. What is the water volume?

- from Table 1, a 10 ft diameter tank contains 48.96 USgal per inch of water depth
- with 8 ft 6 inch depth = 102 inch water depth
- water volume = 48.96 USgal per inch x 102 inch = <u>4994 USgal</u> in a 12 ft x 8 ft tank and 4 ft 6 inch water depth

Example – Horizontal Cylindrical Tank

A horizontal tank is 10 feet in diameter by12 feet long with 8 feet 6 inches of water in it. What is the water volume?

- the Depth Ratio is water depth ÷ tank diameter = 8.5 ft ÷ 10 ft = 0.85 Depth Ratio
- from Table 2, extrapolate 0.85 value: between 0.84 and 0.86 = (89.68 + 91.49) ÷ 2 = 90.59 % capacity
- water volume = 0.9059 x 10 ft x 10 ft x 12 ft x 5.875 = <u>6387 USgal</u> in a 10 ft dia. x 12 ft tank and 8 ft 6 inch water depth

Example – Rectangular Tank

A rectangular tank is 6 feet wide by12 feet long with 4 feet 6 inches of water in it (depth). What is the water volume?

- from Table 3, a 6 ft wide by 12 ft long tank contains 44.9 USgal per inch of water depth
- with 4 ft 6 inch depth = 54 inch water depth
- water volume = 44.9 USgal per inch x 54 inch = <u>2425 USgal</u> in a 12 ft x 6 ft tank and 4 ft 6 in. water depth

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