

Padilla, Cherie

From: Charles G. Brockway [charles.g.brockway@brockwayeng.com]
Sent: Tuesday, April 20, 2010 3:29 PM
To: Padilla, Cherie
Subject: Bokma 37-8662
Attachments: Bokma LCO Water Usage calc.pdf

Cherie,

Attached is the LCO water usage worksheet. I apologize for the omission from the report. Please let me know if you have any other questions.

Thanks,
Chuck

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Livestock Confinement Operations

Water Requirements and Consumptive Use Worksheet

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COMPLETE BLUE HIGHLIGHTED SECTIONS ONLY

Prepared for: Permit 37-8662 Beneficial Use Exam
Harry Bokma (original permittee: Gary Coleman)

Revision: 9801
Run Date: 3/18/2010

Remarks: Calculation represent facility conditions as of 1993

Herd Information - User Input

Number of milking cows 500 Breed: Large
Number of dry cows 110
Number of other adult dry animals 0

Calves at age: Heifers at age:
1 month 0 5 months 130
2 months 0 15 - 18 months 130
3 months 0 18 - 24 months 130
4 months 0

ANIMAL INFORMATION

Use defaults or enter values if known

Average body weight 1400 lbs Nearest weather station Jerome
Milk fat percentage 3.5 % Number of milkings/day 2
Average days dry 65
Annual milk yield per animal 20000 lbs/year Check: Total herd size based on days dry 618
Percent dry matter in ration 90 % HERD SIZE OK

Lagoon Information - User Input

Lagoon Number	Top width	Top length	SS (h:v)	Max depth	Average depth factor	% days with water	Top Area	Bottom Area	Average Area
1	115	355	2	4	0.5	100	40825	37129	38977
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
TOTAL ACRES							0.94	0.85	0.89

Facility Information - User Input

	Holding Pen 1	Holding Pen 2
Holding pen active	1	0 (0 = not used or nonexistent)
Number of sprinklers in pen	50	0
Average line pressure	55	60 psi
Sprinkler nozzle size - primary	9/64	5/32 inches
Sprinkler nozzle size - secondary	3/32	0 (enter 0 for single-nozzle sprinklers)
Daily operation time of sprinklers	30	0 minutes
Percent of days per year cows are washed	100	0 %
Manual flush of holding pen	3000	3000 gal
Amount of manual flush which is second-use after coolers	3000	3000 gal
Number of free stalls	0	
Length of each free stall	1000 feet	
Width of each free stall	50 feet	
Is the feeding area flushed to lagoon?	No	
Is this housing area flushed to lagoon?	No	

	Feeding	Housing
Flushing recycle rate	0	0

COOLING WATER VOLUMES

	Flow	Operation time
Vacuum pumps	7.5 gpm	12 hours/day
Plate cooler	15 gpm	12 hours/day

CLEANING / FLUSHING VOLUMES

Use defaults or enter manufacturer volumes

Cleaning parlor floor	2000 gal	Cleaning pipeline	70 gal
Cleaning milkroom	100 gal	Cleaning equipment	200 gal
Cleaning bulk tank	70 gal		
Additional flush of holding pen (opt.)	0 gal	Amount of above volumes which is second use after coolers	2000 gal

Land Application Information - User Input

Type of system	Center Pivot
Predominant cropping	Alfalfa
Percent of waste water which goes to meet crop irrigation requirement	90 %

Stockwater Component

Drinking Water Calculation for Lactating Cows

4% fat-corrected milk yield	18500 lbs/year
Daily average FCM yield	61.67 lbs/day
Daily average milk yield	66.67 lbs/day
Estimated DMI	46.19 lbs/day

METHOD 1: Kertz

Estimated total water intake (TWI)	272.0 lbs/day or 32.6 gal/day
As-fed feed daily intake	51.3 as-fed lb/day
Water content of feed	5.13 lb/day in feed
Drinking water intake	266.9 lb/day or 32.0 gal/day
Drinking water requirement for lactating cows	16000 gal/day 17.9 ac-ft/year

METHOD 2: Holter and Urban

Regression equation with DMI, milk production, and dry matter %

Drinking water intake	98.1 liters/day 25.9 gal/day
	12956 gal/day 14.5 ac-ft/year

Maximum drinking water requirement 17.9 ac-ft/year

Drinking Water Calculation for Dry Cows

Estimated DMI	26.6 lbs/day
Average drinking water intake	13 gal/day

Average drinking water requirement 1430 gal/day
1.6 ac-ft/year

Drinking Water Calculation for Replacement Herd (Calves and Heifers)

Age	GPD	Ac-Ft/year
1 mo	0	0.00
2 mo	0	0.00
3 mo	0	0.00
4 mo	0	0.00
5 mo	546	0.61
15-18 mo	845	0.95
18-24 mo	1099	1.23

Drinking water requirement
for replacement herd 2490 gpd 2.79 ac-ft/year

TOTAL STOCKWATER COMPONENT 22.3 AC-FT/YEAR

Commercial Component

Milking Parlor Water Usage Calculation

Volume needed *per milking* in each parlor for:

Cleaning parlor floor	2000 gal	Cleaning pipeline	70 gal
Cleaning milkroom	100 gal	Cleaning equipment	200 gal
Cleaning bulk tank	70 gal	Cleaning cows	250 gal

Total milking parlor volume	5380 gal/day
Second milking parlor volume	0 gal/day
Second-use water (deduct)	2000 gal/day
	3.79 ac-ft/year

Holding Pen Water Usage Calculation

	Pen 1	Pen 2
Output of primary nozzle	4.07	5.5 gpm
Output of secondary nozzle	1.8	0 gpm
Holding pen manual flush	3000	0 gal
Additional flush volume	0	0 gal
Sprinkler volume	8805	0 gal/day

Total holding pen volume	11805	0 gal/day
Second-use water (deduct)	3000	0 gal/day

9.86 ac-ft/year

Cooling Water Calculation

Daily volume needed for:

Vacuum pump cooling	5400 gal/day
Plate cooler	10800 gal/day

Other Flushing Water Calculation

Daily volume needed for:

Feeding area flushing	0 gal/day
Housing area flushing	0 gal/day

Total other flushing volume	0 gal/day
Recycled water	0
	0.00 ac-ft/year

TOTAL COMMERCIAL COMPONENT 13.6 AC-FT/YEAR

Consumptive Use Calculation

A. Lagoon Evaporation

Annual reference ET (Allen & Brockway , 1983)	4.51 feet	
Annual open water coeff (Kohler Nordenson Fox)	0.90	
Annual open water (lagoon) evaporation	4.06 feet	
Manual override: Input annual lagoon evap	feet	
Total lagoon water surface area at full	40825 sq. ft.	
Total lagoon bottom area	37129 sq. ft.	
Average surface area when water is present	38977 sq. ft. =	0.89 ac

Total lagoon evaporation 3.64 ac-ft/year

B. Animal usage: milk, metabolism, and excretion loss

	Milking	Dry
Waste excretion volume per cow	1.3	1.3 ft ³ /day/1000lb
Water content	87.5	88.4 %
Total water volume in excrement	5956	1324 gal/day
Percent of excrement flushed to lagoons	15 % (based on areas which are flushed)	
Consumptive use (evap.) of water in excrement	85 %	
Consumptive use (evap.) volume	6188 gal/day	
Excrement c.u. attributable to drinking water	6071 gal/day	
Total milk production - assume 100% leaves site	33333 lbs/day or	3997 gal/day
Water content of milk	3477 gal/day	
Water content attributable to drinking water	3412 gal/day	
Water use for animal metabolism	6981 gal/day	
Metabolism water attributable to drinking water	6849 gal/day	
Consumptive use - replacement herd (100%)	2490 gal/day	
Total animal consumptive use from drinking water	18821 gal/day or	21.1 ac-ft/year
Percent of drinking water intake	108.0 %	

C. Parlor/holding pen cleanup

Average sprinkler washing system evap loss	2 %	
Free stall total area	0 sq. ft. =	0.00 acres
Length of time free stall concrete is wet	1 hr/day	
Average evaporation from wet concrete	0.15 in./day	
Sprinkler system loss volume	0.20 ac-ft/year	
Free stall evaporation volume	0.00 ac-ft/year	
Total cleanup loss	0.20 ac-ft/year	

D. Land application site

Crop evapotranspiration	3.29 ac-ft/ac/year
Irrigation diversion volume	4.11 ac-ft/ac/year
System efficiency	80 %
Waste water volume to lagoons	14.7 ac-ft/year
Waste water volume available for land application	11.0 ac-ft/year
Total crop consumptive use of waste water	8.0 ac-ft/year

Summary

Drinking Water

Milking herd	17.9
Non-milking herd (dry cows)	1.6
Replacement herd (calves and heifers)	2.8

Total drinking water volume	22.3 ac-ft/year
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Commercial

Milking parlor	3.79
Holding pen and cleanup	9.9
Other flushing water	0.00

Total commercial volume	13.6 ac-ft/year
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TOTAL DIVERSION VOLUME REQUIREMENT	36.0 AC-FT/YR
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Consumptive Use

Lagoon evaporation	3.64
Animal milk, excretion, & metabolism	21.1
Parlor and holding pen cleanup	0.20
Crop consumptive use on land application	8.0

Total consumptive use	32.9 ac-ft/year
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Percent of diversion volume consumed	91.4 %
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Annual crop consumptive use - IDWR allowable	3.0 afa
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Equivalent irrigated acres	11.0 acres
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Diversion volume to acres conversion factor	3.28 ac-ft/ac
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