Preliminary Statistical Analysis
IDWR ESPA Dairy Water Use Sample
Brockway Engineering PLLC June 30, 2007

The Idaho Department of Water Resources conducted an evaluation of water pumped for dairies on a sample of 23 dairies within the Eastern Snake Plain Aquifer area. This analysis was conducted to determine whether the estimated 29.1 gpd/cow, which the Idaho Dairymen's Association used in determining the aquifer depletion by member users was adequate mitigation in response to pending spring user delivery calls.

According to the Department, the sample of dairies it selected was based on the availability of 2005 pumping volume data and corresponding animals served. Based on the Idaho Department of Agriculture data, there were some 319 dairies documented for the 2005 season.

An analysis of the statistical differences in water use between the sample of 23 dairies and the total IDA population was not possible because water use data was only provided for the 23-dairy sample. However, a preliminary statistical analysis of the numbers of cows in the total population versus the 23-dairy sample is shown in Table 1

Table 1 PRELIMINARY STATISTICAL ANALYSIS ESPA DAIRIES

IDWR Sample*		****Total Dairies IDA**	
Mean	2657.5	Mean	701.3
Standard Error	587.7	Standard Error	59.9
Median	1800	Median	320
Mode	1800	Mode	50
Standard Deviation	2628.4	Standard Deviation	1070.5
Sample Variance	6908462	Sample Variance	1145993
Kurtosis	2.66490	Kurtosis	21.53235
Skewness	1.769506	Skewness	3.926579
Range	9430	Range	8694
Minimum	370	Minimum	6
Maximum	9800	Maximum	8700
Sum	53150	Sum	223706
Count	20	Count	319

*23 Dairies selected by IDWR based on 2005 water use analyses-modified by Brockway Engineering based on local knowledge of source/use anomalies.
** Dairies on ISDA data sheet. Cow numbers based on 2005 data

The above analysis shows that the mean dairy size based on the total IDA population was 701.3 cows per dairy compared to the mean of 2657.5 cows per dairy in the IDWR 23-dairy sample. This difference indicates that IDWR's 23-dairy sample population average is 3.8 times larger than the average dairy size of the 2005 census of

319 IDA member dairies. Although the 23 dairies sampled represent only 7.2 percent of the total number of dairies reported in 2005, the total number of cows represented in that sample was 23% of the total 2005 cow population.

Similarly, the sample variance of the IDWR 23-dairy sample is $6.9x10^6$, compared to the total 2005 population variance in cow numbers of $1.1x10^6$, or over six times greater. These differences in sample and population statistics indicate that the IDWR selected sample of 23 dairies is substantially skewed toward dairies with higher than average cow numbers, that have non-drinking water uses that are typically larger than average, and therefore, they are not representative of the IDA member population. Consequently, the statistical significance of the per cow water use estimates based on the IDWR sample are highly suspect.

This is particularly true because there are significant differences in water use per cow depending on numerous factors, including the spatial distribution and location of dairies, hydraulic configurations for water use, water management differences depending on personnel and topography within the dairy site and milk production per gallon of water diverted. *See for example* Response to IDWR 23-Dairy Sample Analysis by Matt Thompson, AGTec. The small sample size used by IDWR is not adequate to evaluate all of the differences and correlations which exist within a population as diverse as the ESPA dairies.

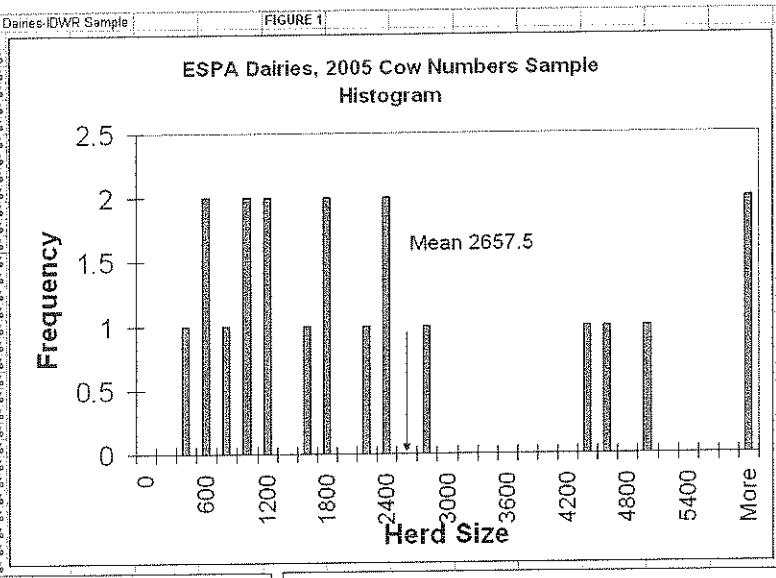
Because the dairy size has a significant influence on average water use per cow, the selection of a sample that accurately reflects the average population dairy size is critical. Figures 1 and 2 show the frequency histogram and percentage distribution of herd size of the dairies in the IDA data base and the IDWR sample. Neither of the histograms show a normal distribution of dairy cow numbers. The histograms do show that over 40% of the dairies in the IDA data base include less than 400 cows whereas only 5% of the IDWR sample data base includes dairies with 400 or fewer cows.

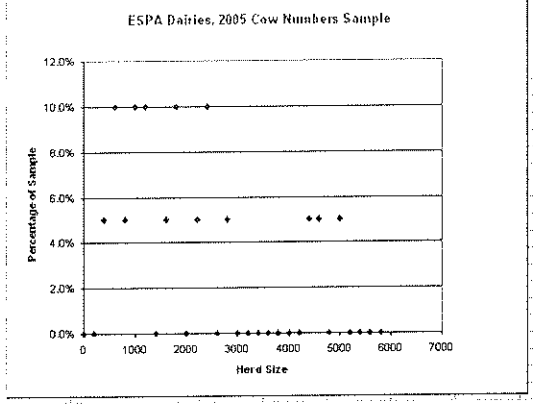
A statistical analysis could be designed and undertaken that identifies a sample size and population to account for the variability among dairies and provide a representative sample for analysis of average water use per cow. Based on the statistical analysis showing a heavily skewed IDWR sample summarized here, in my opinion, the average actual water use per cow revealed by such a study would be significantly less than the 74 gpd number derived from averaging the 23-dairy sample used by IDWR.

Preliminary Statistical Analysis-IDA ESPA Daines-IDWR Sample

FIGURE 1

Bin	Frequency	%	cum %
0	0	0.0%	0.0%
200	0	0.0%	0.0%
400	1	5.0%	5.0%
600	2	10.0%	15.0%
800	1	5.0%	20.0%
1000	2	10.0%	30.0%
1200	2	10.0%	40.0%
1400	0	0.0%	40.0%
1600	1	5.0%	45.0%
1800	2	10.0%	55.0%
2000	0	0.0%	55.0%
2200	1	5.0%	60.0%
2400	2	10.0%	70.0%
2600	0	0.0%	70.0%
2800	1	5.0%	75.0%
3000	0	0.0%	75.0%
3200	0	0.0%	75.0%
3400	0	0.0%	75.0%
3600	0	0.0%	75.0%
3800	0	0.0%	75.0%
4000	0	0.0%	75.0%
4200	0	0.0%	75.0%
4400	1	5.0%	80.0%
4600	1	5.0%	85.0%
4800	0	0.0%	85.0%
5000	1	5.0%	90.0%
5200	0	0.0%	90.0%
5400	0	0.0%	90.0%
5600	0	0.0%	90.0%
5800	0	0.0%	90.0%
More	2	10.0%	100.0%





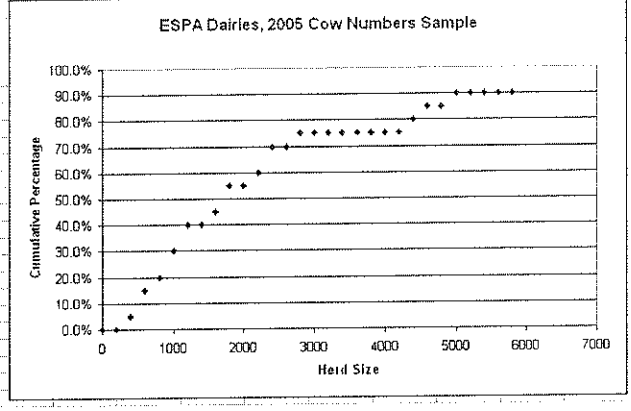
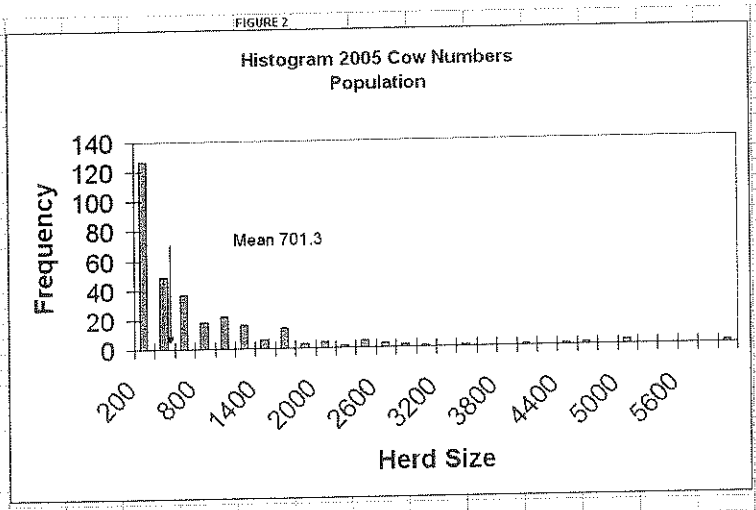
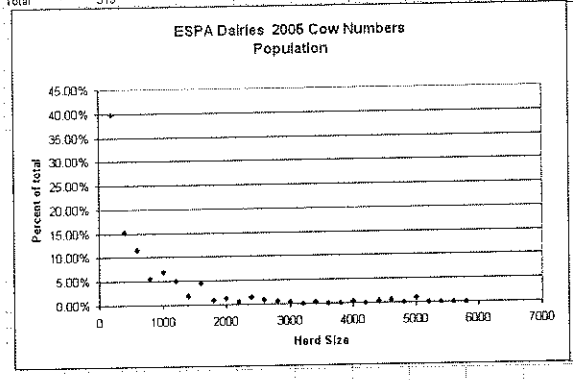


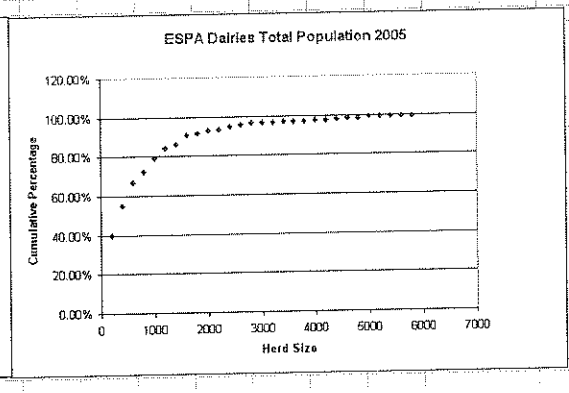
FIGURE 2

Preliminary Statistical Analysis-IDA ESPA Dairies

Bin	Frequency	%	Cum%
200	127	39.81%	39.81%
400	49	15.36%	55.17%
600	37	11.60%	66.77%
800	18	5.64%	72.41%
1000	22	6.90%	79.31%
1200	16	5.02%	84.33%
1400	6	1.88%	86.21%
1600	14	4.39%	90.60%
1800	3	0.94%	91.54%
2000	4	1.25%	92.79%
2200	2	0.63%	93.42%
2400	5	1.57%	94.98%
2600	3	0.94%	95.92%
2800	2	0.63%	96.55%
3000	1	0.31%	96.87%
3200	0	0.00%	96.87%
3400	1	0.31%	97.18%
3600	0	0.00%	97.18%
3800	0	0.00%	97.18%
4000	1	0.31%	97.49%
4200	0	0.00%	97.49%
4400	1	0.31%	97.81%
4600	2	0.63%	98.43%
4800	0	0.00%	98.43%
5000	3	0.94%	99.37%
5200	0	0.00%	99.37%
5400	0	0.00%	99.37%
5600	0	0.00%	99.37%
5800	0	0.00%	99.37%
More	2	0.63%	100.00%
Total	319		







RESPONSE TO IDWR 22-DAIRY SAMPLE ANALYSIS

Matt Thompson
AGTec

1. Consumptive Use Associated with Dairy Diversions

The parties to the Mitigation Agreement intended that the Agreement is not a mitigation plan for total diversions of Ida's members, but a plan for offsetting consumptive uses (i.e., depletions to the ESPA) of the participating members' dairy facilities. IDWR's assumption that all water diverted and used on a dairy facility is consumptive (and therefore depletive and subject to the Agreement) is incorrect. While that assumption may make the processing of water transfers and associated rights easier to process its application to a mitigation plan is inappropriate. The two main components of dairy water usage, cattle drinking and parlor commercial usage each have a non-consumptive component. Housing type and facility design and management determine how much non-consumptive use there is on each individual dairy facility. For example, the following is a list of potential non-consumptive cattle uses. It should not be considered all inclusive.

- Reuse of water extracted from milk from processors. This water either is land applied or discharged to cities or canals for treatment and ultimate discharge to land or surface water. Any land application or discharge to surface water would have a component of incidental recharge and displacement of the diversion of irrigation water under existing rights.

- Collection of water as waste from cows. This moisture is stored and land applied according to the individual facility's Nutrient Management Plan (NMP). The only losses of this moisture are evaporative losses from the stored manure. The amount of moisture collected will vary predominately with housing type.

- All parlor uses. All parlor uses are directly non-consumptive. This water flows through the system and is typically deposited in the lagoon or waste storage system. The water then is typically land applied according to an NMP. The water land applied displaces irrigation water diverted under existing irrigation water rights that would have been applied to grow crops. A portion of this water becomes incidental recharge to the ESPA. All waste water applications from dairy operations are required to be applied to cropped ground during the irrigation season. Special permission from ISDA is required to land apply waste water outside this time period. The only resulting consumptive portion of this water is therefore evaporation from the waste system storage structures.

- The collection of runoff water from facilities and associated land application. All dairy farms are required to provide storage capacity for precipitation runoff from storm events. This stored water is then land applied with the other facility process water described above. This water further displaces the amount of other water that would have been needed to grow facility crops.

2. Inappropriateness of IDWR 22-Dairy Sample

The facility sample set analyzed by IDWR is not a representative sample of the mitigating dairy producers of Water Districts 120 and 130. Brockway Engineering's analysis shows that statistically this is not a representative sample. There are several reasons this data should not be used as basis for determination of the mitigation level.

The mitigation agreement covers up to 339 facilities identified to be within basins 120 and 130 that were included in the depletion model runs used by IDA to calculate depletions. These facilities vary greatly in size and parlor system type. The proposed 29.1 gal/mature head/day is an estimated average among all these facility sizes and types. In comparison, the 22-dairy sample used by IDWR skews heavily toward larger facilities and toward facilities with higher water use per cow. IDWR's initial selection of this sample set perhaps is understandable as typically only diversions of 0.24 cfs or larger have historically been required to have meters. This diversion level, however, results in predominately larger facilities having meters or facilities with higher water use per cow having meters being sampled. It doesn't represent the group as a whole.

The 22 facilities have components not typical of current Idaho facilities. The 22 dairies include a much greater percentage of farms with sprinkler pens and water cooled pumps than the average dairy within the total population. Ten out of twenty of the 22-dairy sample interviewed, or 50%, are using sprinkler pens. The experience of consultants such as Brockway Engineering and AgTec would suggest that less then 20% of the total 339 IDA member dairies would be observed to have sprinkler pens. Six of the twenty farms, or 30%, had water cooled pumps, with 66% of these not recycling the water to cattle drinking. This is atypical of new and expanding dairy farms. Most facilities built or expanded within the last 10 years have air cooled equipment or have plumbed these systems into the cattle drinking system. A mitigation step for these facilities could be to integrate the cattle drinking into the cooling system to eliminate this excess water use.

Cattle drinking water use for the 20 farms interviewed by IDA is higher than that of the average IDA member dairies. There is some, although limited, research on cattle production and drinking water intake. This research suggests there is a strong correlation between the milk production per cow and the drinking water intake. A recent study by Brugger, M. 2006 Water Use and Savings on a Dairy Farm ASABE paper No. 064035, evaluated the water use of a single dairy facility in Ohio. This particular study did an in depth review of water use around the entire facility to gain insight into the water use. This paper also cites other literature and other findings of water use. This paper found that an 80 lb producing herd had an average yearly drinking water use of 20.5 gal/cow/day. This average is a combined average of the milking and dry cows. The total average facility use was 28 gal/cow/day. This results in the average yearly parlor use of 8 gal/cow/day.

Finally, actual 2005 cow numbers for IDA member dairies have been obtained and included in the attached spreadsheet "IDAmitigationcomp07 IDWR spreadsheet070207". We contacted the 22 dairies reviewed by IDWR to get more specific information about each facility. The results

of those interviews are included in the spreadsheet. Of the 22 farms contacted information was obtained on 21 farms with relatively complete information obtained on 19 of the 22 farms. We were not able to obtain and analyze accurate cow numbers for 2 of the farms in the allotted time period and 1 farm didn't respond to any of the contacts made. The spreadsheet shows information for 20 farms. One set of 2 farms were combined on the spreadsheet since the system was tied together for wmis #401517.

As shown in the spreadsheet, pages 2 and 3 are essentially a summary of the information obtained from the interviews with the dairy facilities. This information was then used to obtain a more accurate volume per mature cow for these facilities. Most of the farms (14 of 20) had additional young stock housed on the farm. Several had homes and or lawn associated with the wells. This information was then used to calculate the water needs of these other uses to determine a net mature cow use. Page 4 of the spreadsheet shows the constants that were used in this calculation. The drinking water use for all animals was taken from the "Fresh Water Needs for Dairy Farms" written by Dean Faulk, Extension Dairy Specialist, University of Idaho. This paper corresponds to the "FRESHWAT.XLS" spreadsheet that has been used by IDWR to calculate drinking needs of cattle. The average production for Idaho is 60 lb of milk per lactating cow. From that table, a 60 lb cow needs 26.1 gal/day of water for drinking. The majority of fresh water intake research would suggest that water intake is closely related to milk production. This is why the table has different water intakes for the different milk production levels of cows. To equalize this the spreadsheet used the 26.1gal * 8.34 lbs/gal/60 lbs milk to get 3.6 lbs of water per lb of milk produced. This was checked with using the modified Kertz Equation[1]. This equation predicts freshwater intake based on cow dry matter intake and milk production and test. The referenced manual just happened to have an example of the drinking needs of 60 lb/day cow. The results were 3.6 lbs of water per lb of milk. Since most of the farms interviewed were above the state average production their individual drinking needs for cattle would be higher than the group and this method was the best way to account for the differences between facilities.

Actual 2005 cow numbers are higher than those used in the IDWR analysis of the 22 dairy sample, which reduces the average gpd for the 22 dairies sampled accordingly. This was expected since the 2005 data was estimates and many of those estimates didn't include an accounting for the dry cows. The 2007 ISDA cow estimates were closer to the interviewed numbers. This data is also estimates but ISDA inspectors were including dry cow estimates in these reports. The young stock and other uses accounted for between 0-25% of the total facility diversions. These adjustments, and others, to the IDWR 22-dairy sample, are indicated and shown in the attached spreadsheet.

The number of facilities within this selected subset that have high water use processes and the level of milk production of these facilities suggests that this group doesn't represent the mitigating dairy producers as a whole. It is recommended that a more detailed inventory/survey of the mitigating dairy producers be performed to determine with more confidence the appropriate level of mitigation by the participating producers. An inventory or survey can be

[1] Modified Kertz Equation, A.F. Kertz, Ralston Purina Company, NRAES-63 Dairy Reference Manuel-Third Edition pg 145

utilized to select a representative sample of facilities for a more detailed study if needed to determine group average facility water use.

3. A literature search is not inconsistent with the 29.1 gpd.

The 29.1 gpd number documented in Exhibit B to the Mitigation Agreement is consistent with relevant published data on dairy water use that IDA has been able to obtain. Only one of these published studies, by Brugger and Dorsey, specifically analyzed cow drinking water use and parlor uses. This study estimated overall water use to be 28 gal/mature head/day. Other studies cited by Brugger and Dorsey contain references to higher gpd quantities, but it is clear they are driven by non-drinking water use of the facilities involved and that those studies do not analyze this non-drinking water component in any meaningful way. The Allen study, which dates from 1973 (copy attached) claims to be a study of modern facilities. However, since this study there have been significant changes in facility management and operations to make this study relatively outdated. The drinking water use from this study is applicable and some of the other uses. However, many of the parlor uses and the quantities associated with them are outdated. We have included this study in the materials for your information even though we believe it is obsolete. In short, the one representative study that IDA has been able to find is supportive of the 29.1 gpd quantity used in the Mitigation Agreement.

The Brugger and Dorsey study and the others it cites are consistent in recognizing that numerous variables will affect total water use, and that in particular, non-drinking water uses produce highly variable demands depending on the kinds of facilities involved. This variability highlights the importance of not basing conclusions about average dairy water use on a non-representative sample.

	B	G	H	I	J	K	L	W
1								
2								
3	WMIS POD	2005 Water District Vol. acft	Total Water District Facility Volume 2005 acft	2005 Number of Cows	2005 Number of Cows (corrected)	GPD/05 cow #	%Diff in Cow #'s	Notes:
4	400932	571	571	4420	4450	114.55	1%	This facility also has a milk component separation system that also feeds of this system. Excess cooling water is discharged to a canal for irrigation uses.
5	400103	166	166	2100	2400	61.75	14%	This facility is a milking herd only. Sprinkler Pen only used for clean up in 2007 not for cow washing.
6	401512	104	134	1500	2333	51.28	56%	Includes wmis# 400782, 400783
9	400176	56	56	1500	1076	46.46	-28%	
11	400049	228	382	5000				Cow Numbers NA. The facility has stopped using the deck sprays and flush in 2006 to reduce water use.
12	400092	62	62	850	1000	55.35	18%	
15	400117	147	589	8700	10280	51.18	18%	Includes wmis # 400115, 400116. Also Aardema #4 Dairy is at the same site as Double A Dairy and is served by the same wells.
16	401489	185	185	1200	2260	73.08	88%	
17	400581	79	79	600	1035	68.14	73%	
18	401534	212	211	2700	3319	56.75	23%	Includes wmis # 401535.
23	401517	103	557	4400	5850	85.00	33%	Outside feed alleys are flushed year round using recycled water from lagoons. Includes wmis #401146, 401192, 401516.
24	400860	70	70	560	666	93.83	19%	The facility has abandoned the sprinkler pen in 2006.
26	400067	203	401	4900	6045	59.22	23%	Includes wmis # 400066
27	401138	239	239	2300	3270	65.25	42%	there is also a hospital barn for this facility whose 150 cows were included in the main barn number. The sprinkler pen use has been abandoned in 2006.
28	401151	210	210	1800	2870	65.32	59%	Sprinkler pen use has been abandoned in 2006
30	400089	113	156	1800	2335	59.64	30%	Sprinkler pen is installed but not used.
31	401208	90	90	950	1400	57.39	47%	The facility uses sprinkler pen minimally during bad weather. Deck sprays are installed but not used.
33	400114	12	32	650				Cow Numbers NA.
34	401140	94	94	1050	1400	59.94	33%	
35	400122	40	40	370	450	79.35	15	This facility has lagoons that predominately function as evaporative lagoons.
36		Notes: This spreadsheet is a modified extension of the IDAmitigationcomp07 IDWR spreadsheet. The additional information used within this sheet was obtained through phone interviews with the actual farms to obtain the specific information displayed herein. The enclosed information is complete as possible but all data should be considered propietary and subject to further review by the parties to the IDA Mitigation Agreement.						
37		1-The constants used in this section were taken from various sources. Home and lawn use were supplied by Brockway and referenced from IDWR publications. Cow water use was derived from "Fresh Water Needs for Dairy Farms" publication written by Dean E. Falk, with University of Idaho which also corresponds with the IDWR FRESHWAT.XLS spreadsheet. Milking cow drinking needs were determined using the modified Kertz Equation for a 60 lb producing cow @ 3.7% fat. This resulted in 3.6 lbsH20/lb milk. This equation is found in the Dairy Reference Manual Third Edition NRAES-63.						
38								
39								
40								
41								

	B	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
1		Producer Reported Information											
2					Herd Breakdown for 2006								
3	WMIS POD	Homes served by well(s) after meter	Lawn area served by well(s) (ac.)	Milk Production lbs/day/milk cow	Milking Cows	Dry Cows	0-1 Month	1-2 months	2-3 months	3-4 months	5-15 months	15-18 months	18-24 months
4	400932	0	0.1	70	4450	0	0	0	0	0	0	0	0
5	400103	0	0	90	2400	0	0	0	0	0	0	0	0
6	401512	6	1.5	75	1900	433	300	300	285	285	285		200
9	400176	0	0	70	916	160	33	33	33	26	78		56
11	400049	0	0	83			0	0	0	0	0	0	500
12	400092	0	0	77	850	150	0	0	0	0	0	0	150
15	400117	0	0	76	8739	1541	0	0	0	0	1750	525	1050
16	401489	1	0.1	76	1921	339	0	0	0	0	0	0	0
17	400581	1	0.11	67	900	135	41	41	41	41	410	123	246
18	401534	0	0.15	77	2900	419	0	0	0	0	0	140	280
23	401517	0	0.15	80	5150	700	600	600	600	600	600	0	0
24	400860	3	1	73	569	97	27	27	27	27	270	81	162
26	400067	0	0.15	72	5390	655	0	0	0	0	0	0	0
27	401138	0	0	65	2950	320	0	0	0	0	0	0	800
28	401151	4	1	80	1950	920	0	0	0	0	0	0	0
30	400089	0	0.15	75	1962	373	120	120	120	120	930	270	450
31	401208	1	0.5	75	1200	200	66	66	66	0	0	0	0
33	400114	2	1	60			20	20	20	20	200	60	120
34	401140	0	0	81	1210	190	0	0	0	0	0	0	0
35	400122	0	0	63	390	60	13	13	12	12	50	50	100
36					45747	6692	52439						
37					Total	Total	Sum						
38													
39													
40													
41													

	B	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1													
2		Parlor Water Use Components for 2005									Waste System Use for Flushing		
3	WMIS POD	Plate Cooler	Water Cooled pumps	water Recycled to parlor	water recycled to Cows	Milking Interval	Sprinkler Pen	Deck Sprays	Deck Flush	Claw Backflush	Feed Alleys	Bedding Lanes	Recycled from Lagoon
4	400932	yes	yes	yes	no	3	100%	yes	yes	yes	no	no	no
5	400103	yes	no	yes	yes	3	100%	yes	yes	no	no	no	no
6	401512	yes	no	yes	yes	3	0%	yes	no	no	no	no	no
9	400176	yes	yes	yes	no	2	66%	no	no	yes	no	no	no
11	400049	yes	no	yes	yes	3	0%	yes	yes	yes	no	no	no
12	400092	yes	yes	yes	no	2	100%	yes	no	no	no	no	no
15	400117	yes	no	yes	yes	3	0%	yes	yes	yes	yes	yes	yes
16	401489	yes	yes	yes	yes	2	0%	no	no	yes	no	no	no
17	400581	yes	no	no	no		0%	no	no	yes	no	no	no
18	401534	yes	no	yes	yes	2	25%	yes	yes	yes	no	no	no
23	401517	yes	no	yes	yes	3	0%	yes	yes	yes	yes	no	yes
24	400860	yes	no	yes	no	2	100%	no	no	yes	no	no	no
26	400067	yes	no	yes	yes	3	0%	yes	yes	yes	no	no	no
27	401138	yes	no	yes	yes	2	100%	no	no	yes	no	no	no
28	401151	yes	no	yes	yes	3	100%	no	no	yes	no	no	no
30	400089	yes	no	yes	yes	3	0%	yes	yes	yes	no	no	no
31	401208	yes	yes	yes	yes	3	10%	no	no	no	no	no	no
33	400114	yes	no	yes	no	2	0%	no	no	no	no	no	no
34	401140	yes	no	yes	yes	3	0%	yes	no	yes	no	no	no
35	400122	yes	yes	yes	no	2	100%	no	yes	yes	no	no	no
36													
37													
38													
39													
40													
41													

	B	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF
1		Constants for Water Use Calculations[1]										
2						Young Stock on Farm in 2005						
3	WMIS POD	Gallons Used per home (gal/day)	Volume Used per acre of Lawn (acft)	Pounds of Water used by Milking Cows per lb of Milk Production	Dry Cow Drinking water gal/day/cow	0-1 Month	1-2 months	2-3 months	3-4 months	5-15 months	15-18 months	18-24 months
4	400932	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
5	400103	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
6	401512	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
9	400176	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
11	400049	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
12	400092	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
15	400117	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
16	401489	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
17	400581	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
18	401534	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
23	401517	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
24	400860	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
26	400067	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
27	401138	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
28	401151	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
30	400089	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
31	401208	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
33	400114	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
34	401140	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8
35	400122	500	2.6	3.6	12	2.5	2.5	2.5	4.6	7.9	10.8	10.8

Notes: This spreadsheet is a modified extension of the IDAmitigationcomp07 IDWR spreadsheet. The additional information used within this sheet was obtained through phone interviews with the actual farms to obtain the specific information displayed herein. The enclosed information is complete as possible but all data should be considered propietary and subject to further review by the parties to the IDA Mitigation Agreement.

1-The constants used in this section were taken from various sources. Home and lawn use were supplied by Brockway and referenced from IDWR publications. Cow water use was derived from "Fresh Water Needs for Dairy Farms" publication written by Dean E. Falk, with University of Idaho which also corresponds with the IDWR FRESHWAT.XLS spreadsheet. Milking cow drinking needs were determined using the modified Kertz Equation for a 60 lb producing cow @ 3.7% fat. This resulted in 3.6 lbsH20/lb milk. This equation is found in the Dairy Reference Manual Third Edition NRAES-63.

	B	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ
1		Calculated Consumptive Use Estimates Excluding Parlor Use										
2		Mature Herd		Young Stock on Farm in 2005								
3	WMIS POD	Milking Herd af/yr	Dry Cows af/yr	0-1 month af/yr	1-2 months af/yr	2-3 months af/yr	3-4 months af/yr	5-15 months af/yr	15-18 months af/yr	18-24 months af/yr	Home Use af/yr	Lawn Use af/yr
4	400932	150.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
5	400103	104.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	401512	68.89	5.82	0.84	0.84	0.80	1.47	2.52	0.00	2.42	3.36	3.90
9	400176	31.00	2.15	0.09	0.09	0.09	0.13	0.69	0.00	0.68	0.00	0.00
11	400049	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.05	0.00	0.00
12	400092	31.64	2.02	0.00	0.00	0.00	0.00	0.00	0.00	1.81	0.00	0.00
15	400117	321.07	20.71	0.00	0.00	0.00	0.00	15.48	6.35	12.70	0.00	0.00
16	401489	70.58	4.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.26
17	400581	29.15	1.81	0.11	0.11	0.11	0.21	3.63	1.49	2.98	0.56	0.29
18	401534	107.95	5.63	0.00	0.00	0.00	0.00	0.00	1.69	3.39	0.00	0.39
23	401517	199.17	9.41	1.68	1.68	1.68	3.09	5.31	0.00	0.00	0.00	0.39
24	400860	20.08	1.30	0.08	0.08	0.08	0.14	2.39	0.98	1.96	1.68	2.60
26	400067	187.60	8.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39
27	401138	92.70	4.30	0.00	0.00	0.00	0.00	0.00	0.00	9.68	0.00	0.00
28	401151	75.41	12.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24	2.60
30	400089	71.13	5.01	0.34	0.34	0.34	0.62	8.23	3.27	5.44	0.00	0.39
31	401208	43.51	2.69	0.18	0.18	0.18	0.00	0.00	0.00	0.00	0.56	1.30
33	400114	0.00	0.00	0.06	0.06	0.06	0.10	1.77	0.73	1.45	1.12	2.60
34	401140	47.38	2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	400122	11.88	0.81	0.04	0.04	0.03	0.06	0.44	0.60	1.21	0.00	0.00
36												
37												
38												
39												
40												
41												

	B	BR	BS	BT	BU	BV	BW
1		Results					
2		Subtotal on Young Herd and Household uses af/yr	% of Heifer and Household use from total	Remaining Volume for Mature & Parlor Use af/yr	Calc.Vol.of Drinking for Mature herd gal/cow/day	Remaining Parlor Usage gal/mature cow/day	Total Mature Herd Usage gal/head/day
3	WMIS POD						
4	400932	0.26	0%	570.7	30.2	84.3	114.5
5	400103	0.00	0%	166.0	38.8	22.9	61.7
6	401512	16.15	12%	117.9	28.6	16.5	45.1
9	400176	1.78	3%	54.2	27.5	17.5	45.0
11	400049	6.05	2%	376.3	NA	NA	NA
12	400092	1.81	3%	60.2	30.0	23.7	53.7
15	400117	34.53	6%	554.8	29.7	18.5	48.2
16	401489	0.82	0%	184.2	29.7	43.1	72.7
17	400581	9.49	12%	69.5	26.7	33.2	60.0
18	401534	5.47	3%	205.5	30.5	24.7	55.3
23	401517	13.83	2%	543.2	31.8	51.1	82.9
24	400860	9.97	14%	60.0	28.7	51.8	80.5
26	400067	0.39	0%	400.6	29.0	30.2	59.2
27	401138	9.68	4%	229.3	26.5	36.1	62.6
28	401151	4.84	2%	205.2	27.3	36.5	63.8
30	400089	18.95	12%	137.0	29.1	23.3	52.4
31	401208	2.41	3%	87.6	29.5	26.4	55.8
33	400114	7.94	25%	24.1	NA	NA	NA
34	401140	0.00	0%	94.0	31.8	28.1	59.9
35	400122	2.42	6%	37.6	25.2	49.4	74.5
36							
37							
38							
39							
40							
41							

Calculating Drinking Water Intake for Lactating Cows

Drinking water intake for lactating cows largely depends on production level. It can be estimated using the modified Kertz Equation (A. F. Kertz, Ralston Purina Company):

total water intake (lbs/day) = (4 x dry-matter intake) + lbs of 4% fat-corrected milk (FCM) + 25.6

drinking water intake (lbs/day) = total water intake – ration water intake

Example: Determine the drinking water intake for a 1,350-pound Holstein cow producing 60 pounds of milk with a 3.7% milk fat test. The moisture content of the ration is 55% (45% dry matter). From table 5.32, the 4% FCM is 57.3 pounds (60 x 0.955). From table 5.34, the estimated dry-matter intake is 43 pounds [0.0319 (percent form of the average of 3.13 and 3.25) x 1,350]. Use actual dry-matter intake when it is available.

total water intake = (4 x 43) + 57.3 + 25.6

= 254.9 lbs of total water daily or

= 30.6 gallons (254.9 ÷ 8.34) or

= 4.4 lbs per lb of 4% FCM produced daily (254.9 ÷ 57.3)

drinking water intake = 254.9 – 52.5*

= 202.4 lbs of drinking water daily or

= 24.3 gallons or

= 3.6 lbs per lb of 4% FCM produced daily

* Ration water intake is derived as follows:

total as-fed lbs of feed = dry-matter intake ÷ percent dry matter
= 43 ÷ 0.45 = 95.5 lbs

ration water intake = total as-fed lbs of feed x ration moisture content
= 95.5 x 0.55 = 52.5 lbs

When water is being metered for milk cows, make sure other livestock (for example, heifers, dry cows, beef cattle, or a bull) that have access to the same watering source are properly discounted so an accurate estimate of water intake can be achieved. Water from ration usually runs 25 to 50 pounds daily on low- and high-silage rations respectively. Somewhat lower intakes may be expected in cold weather and higher ones in hot weather. References dealing with water intake in greater detail are *Journal of Dairy Science* 66 (1983): 35 and *Journal of Dairy Science* 75 (1992): 1,472.