

Saxton, Craig

From: Weaver, Mathew
Sent: Wednesday, February 01, 2012 9:26 AM
To: Saxton, Craig
Subject: Flowers Bench Matter

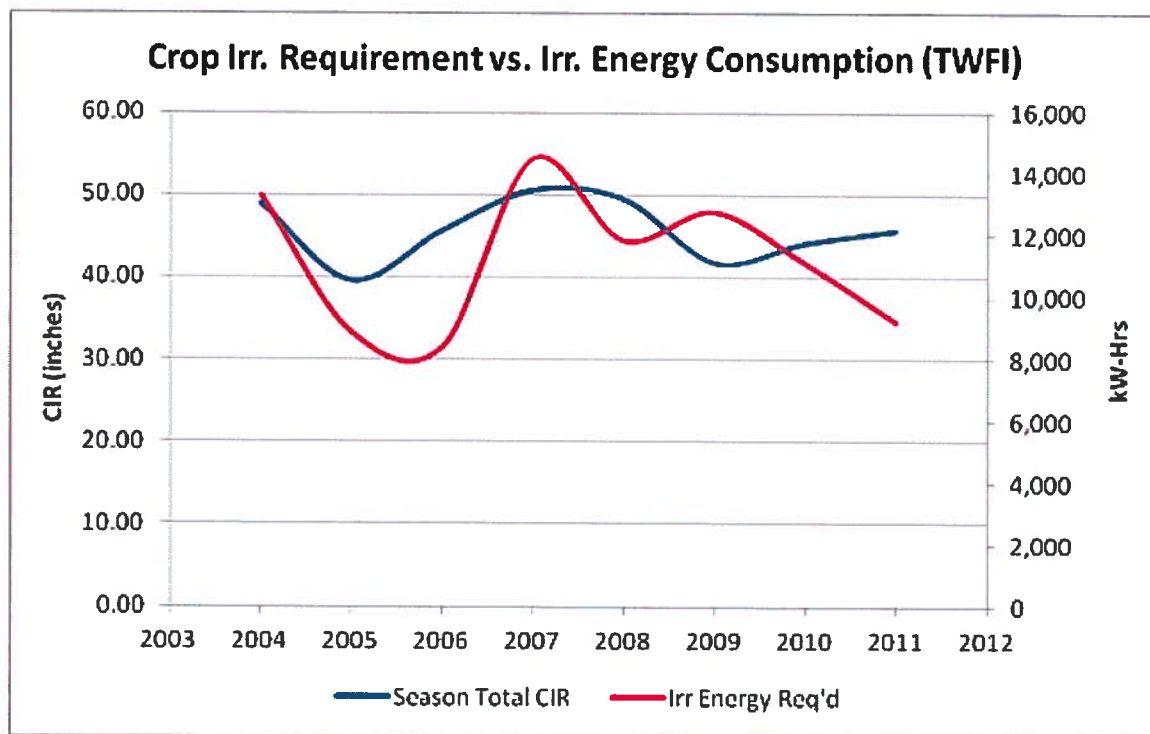
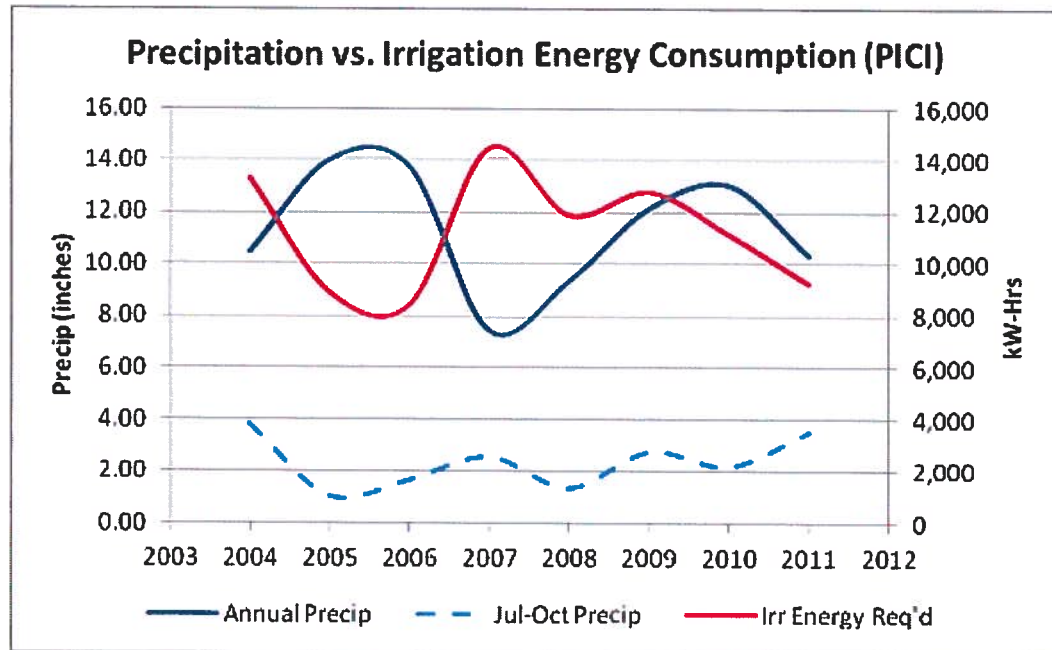
Craig,

All in all I think Brockway's approach has merit, especially in light of no other means of arriving at a seasonal volume. I do have some questions regarding the power data, especially the season total irrigation energy values used by Brockway (cells F13:F20), which are used to derive the seasonal volumes of irrigation water. Potentially this issue should be addressed by Brockway, but I'll leave that up to you to decide. I put an updated version of Brockway's spreadsheet on my P:\ titled '37-8752_PCCWorksheet.xlsx' for your review. In it I detail how they calc'd the PCC value along with other pertinent information. I do have a few questions for you to consider.

Questions,

- 1) In the field exam what is meant by a 20 hp motor on a 10 hp pump? Is the pump being over-horsed? Is it a submersible with a booster? Power records suggest that it is primarily a 10 hp diversion or slightly more after 2008. What's going on before 2008?
- 2) What power consumption is occurring at the site in addition to the irrigation pump. Sometimes the power consumption is as high as 5-6 kW during the non-irrigation season (Sept 2009 and June 2007) and 7.5 kW during the irrigation season (Sept 2007)? Without understanding power usage better can we really isolate the energy used for irrigation?
- 3) Why does the power demand in the irrigation season (after subtracting out the base power) still exceed the power requirement of the 10 hp submersible irrigation pump (more severe from 2004-2007)?
- 4) If the pump is being over-horsed, or if there is more than one pump used to divert water for irrigation, then the PCC value will be greater (i.e. avg. 395) resulting in a lower seasonal irrigation diversion volume.
- 5) Refer to first figure below for plot of precipitation (annual and irrigation season) at the Picabo AgriMet Station versus total energy required during the irrigation season less the 'base' energy. Through 2007 the relationship is what we would expect, when precip is up energy used for irrigation is down, but from 2008 and on the relationship breaks down suggesting power consumption for some other reason besides irrigation is confounding the relationship. What changed after 2007 effecting the relationship? Is the data from after 2007 valid for analysis?
- 6) Refer to the second figure below for a plot of crop irrigation requirement (ETr – Effective Precip) at the Twin Falls AgriMet Station versus total energy required during the season less the 'base' energy. In this instance through 2008 the relationship is what we would expect, when CIR is up energy used for irrigation is up, but from 2009 and on the relationship breaks down reinforcing the idea that power consumption for other reasons besides irrigation is confounding the relationship. What changed after 2008 effecting the relationship? Is the data from after 2008 valid for analysis?

I'd love to talk about if you would like. I'll put the folder back in your in-basket. I really enjoyed working on this problem. It was good to refresh my understanding of the PCC relationship method.



Volume Calculation - Alternate Approach MDW 1/31/2012

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Year	Irr. Season (kW-Hrs)	Well Power Demand (kW)	Pump On (Hrs)	Div. Rate (GPM)	Div. Rate (GPH)	Div. Volume (Gallons)	Div. Volume (CF)	Div. Volume (Ac-Ft)	2.5 AFA per Irr. Acre	% CIR Provided	1.48 AFA per Irr. Acre	% CIR Provided	Average AFA
2004	10,852	7.52	1,443	130	7,800	11,256,064	1,504,821	34.55	36.25	95.3%	21.46	161.0%	2.4
2005	6,626	7.52	881	130	7,800	6,872,268	918,752	21.09	36.25	58.2%	21.46	98.3%	1.5
2006	5,544	7.52	737	130	7,800	5,750,277	768,754	17.65	36.25	48.7%	21.46	82.2%	1.2
2007	12,224	7.52	1,626	130	7,800	12,679,593	1,695,133	38.91	36.25	107.4%	21.46	181.3%	2.7
2008	9,571	7.52	1,273	130	7,800	9,926,848	1,327,119	30.47	36.25	84.0%	21.46	142.0%	2.1
2009	10,877	7.52	1,446	130	7,800	11,281,550	1,508,229	34.62	36.25	95.5%	21.46	161.3%	2.4
2010	9,276	7.52	1,233	130	7,800	9,620,864	1,286,212	29.53	36.25	81.5%	21.46	137.6%	2.0
2011	7,786	7.52	1,035	130	7,800	8,075,904	1,079,666	24.79	36.25	68.4%	21.46	115.5%	1.7

1 - Calendar Year

2.0 265

2 - Total Power Consumption from the Irrigation Season Less the Base Power Demand

3 - Power requirement of the well/pump system assuming the Hydraulic Horse Power Equation (converted to kW output) and a Q = 130 gpm, TDH = 205 feet, and $\eta = 0.67$.

4 - Number of hours the pump was operated for irrigation.

5, 6 - Diversion rate of the well at the operating condition described by the Brockway Technical Memo dated January 25, 2012 in gpm and gallons per hour units respectively.

7, 8, 9 - Volume of water diverted from the well (flow rate x time period) during the irrigation season in gallon, cubic feet, and acre-feet units respectively.

10 - Seasonal volume of water required for the irrigation of 14.5 acres assuming a crop irrigation requirement (CIR) of 2.5 AFA/acre.

11 - Percent of CIR met by the actual diversion of water at the well assuming 2.5 AFA/ac.

12 - Seasonal volume of water required for the irrigation of 14.5 acres assuming a CIR of 1.48 AFA/acre.

13 - Percent of CIR met by the actual diversion of water at the well assuming 1.48 AFA/acre.

14 - Average acre feet per acre diverted each year 6.5

Flowers Bench Subdivision
Power Record Analysis - Irrigation Well
CGB 1/12/12, Modified MDW 1/31/2012

Derived PCC = 311.6 KWH/ac-ft
Acres (water right): 14.5 acres
Acres (actual irrigation): 15.5 acres

ETIdaho Interpolated Pdef	Irr. Pump (Goulds 150L10 Submersible Pump)*	Irr. Motor (Franklin)*
Pasture Pdef = 1.48 afa		20 hp
From Allen & Robison 2009	10 hp	14.914 kW
	7.457 kW	*Data from Field Exam
	*Data from Field Exam	

Yearly Summary

Year	KWH total irrig season	No. months	KWH avg base mnthly	Net irrig KWH	Ac-ft	Ac-ft/ac on 14.5 ac	Implied efficiency	MDW PCC	MDW Irr. Dem. (hp)
2004	13,312	6	410	10,852	34.8	2.40	0.62	455.4	14.6
2005	8,887	5	452	6,626	21.3	1.47	insuf	430.9	13.8
2006	8,421	5	575	5,544	17.8	1.23	insuf	420.2	13.5
2007	14,478	5	451	12,224	39.2	2.71	0.55	433.4	13.9
2008	11,872	4	575	9,571	30.7	2.12	0.70	344.7	11.1
2009	12,778	5	380	10,877	34.9	2.41	0.61	360.5	11.6
2010	11,143	4	467	9,276	29.8	2.05	0.72	313.3	10.1
2011	9,240	4	364	7,786	25.0	1.72	insuf	365.5	11.7

	Ac-ft	Ac-ft/acre (14.5 ac)	Ac-ft/acre (15.5 ac)
Mean	29.2	2.01	1.88
Max	39.2	2.71	2.53
Min	17.8	1.23	1.15

Idaho Power Records and Monthly Readings

Monthly Energy Req'r

Max. Monthly Power Req'r

Read Date	SA Type	Days	Read Code	Bill Amount (\$)	Usage kW- Hrs	Demand (kW)	Base Energy (kW-Hrs)	Total - Base Energy (kW-Hrs)	Base Demand (kW)	Total - Base Demand (kW)	Total - Base Demand (hp)	PCC (kW- hrs/ac-ft)
12/13/2011	EC-LG	33	R	60.37	537	3.00	364	174	3.25	-0.25	-0.34	-10
11/10/2011	EC-LG	29	R	41.07	308	2.00	364	-56	3.25	-1.25	-1.68	-52
10/12/2011	EC-LG	30	R	164.18	1,769	12.00	364	1,406	3.25	8.75	11.73	366
9/12/2011	EC-LG	32	R	228.78	2,834	12.00	364	2,471	3.25	8.75	11.73	366
8/11/2011	EC-LG	29	R	220.98	2,419	12.00	364	2,056	3.25	8.75	11.73	366
7/13/2011	EC-LG	30	R	212.83	2,218	12.00	364	1,855	3.25	8.75	11.73	366
6/13/2011	EC-LG	32	R	27.59	141	10.00	364	-223	3.25	6.75	9.05	282
5/12/2011	EC-LG	29		31.95	198	3.00	364	-166	3.25	-0.25	-0.34	-10
4/13/2011	EC-LG	30		32.55	205	2.00	364	-159	3.25	-1.25	-1.68	-52
3/14/2011	EC-LG	32		33.75	219	2.00	364	-145	3.25	-1.25	-1.68	-52
2/10/2011	EC-LG	28	L	70.86	650	2.00	364	287	3.25	-1.25	-1.68	-52
1/13/2011	EC-LG	30	L	70.86	650	2.00	364	287	3.25	-1.25	-1.68	-52
12/14/2010	EC-LG	32	L	70.86	650	2.00	467	183	4.75	-2.75	-3.69	-115
11/12/2010	EC-LG	30		53.13	444	12.00	467	-23	4.75	7.25	9.72	303
10/13/2010	EC-LG	30	R	199.04	2308	13.00	467	1,841	4.75	8.25	11.06	345

9/13/2010	EC-LG	32	R	246.88	3160	13.00	467	2,693	4.75	8.25	11.06	345
8/12/2010	EC-LG	29	R	245.19	2884	11.00	467	2,417	4.75	6.25	8.38	261
7/14/2010	EC-LG	30	R	241.19	2791	12.00	467	2,324	4.75	7.25	9.72	303
6/14/2010	EC-LG	32		28.44	160	12.00	467	-307	4.75	7.25	9.72	303
5/13/2010	EC-LG	29		38.23	289	2.00	467	-178	4.75	-2.75	-3.69	-115
4/14/2010	EC-LG	30	R	34.13	242	4.00	467	-225	4.75	-0.75	-1.01	-31
3/15/2010	EC-LG	32		69.62	650	2.00	467	183	4.75	-2.75	-3.69	-115
2/11/2010	EC-LG	28	L	69.62	650	2.00	467	183	4.75	-2.75	-3.69	-115
1/14/2010	EC-LG	30	L	69.62	650	2.00	467	183	4.75	-2.75	-3.69	-115
12/15/2009	EC-LG	32		65.63	604	2.00	380	224	3.57	-1.57	-2.11	-66
11/13/2009	EC-LG	30		24.92	136	5.00	380	-244	3.57	1.43	1.92	60
10/14/2009	EC-LG	30	R	183.84	1963	12.00	380	1,583	3.57	8.43	11.30	352
9/14/2009	EC-LG	32	R	206.87	2209	12.00	380	1,829	3.57	8.43	11.30	352
8/13/2009	EC-LG	29		256.22	3050	12.00	380	2,670	3.57	8.43	11.30	352
7/15/2009	EC-LG	30	E	246.39	2850	13.00	380	2,470	3.57	9.43	12.64	394
6/15/2009	EC-LG	32		215.84	2706	12.00	380	2,326	3.57	8.43	11.30	352
5/14/2009	EC-LG	29		41.83	373	10.00	380	-7	3.57	6.43	8.62	269
4/15/2009	EC-LG	30		42.67	384	2.00	380	4	3.57	-1.57	-2.11	-66
3/16/2009	EC-LG	32		44.51	410	2.00	380	30	3.57	-1.57	-2.11	-66
2/12/2009	EC-LG	29		40.92	371	2.00	380	-9	3.57	-1.57	-2.11	-66
1/14/2009	EC-LG	30		41.48	384	2.00	380	4	3.57	-1.57	-2.11	-66
12/15/2008	EC-LG	32		43.41	410	3.00	575	-165	3.75	-0.75	-1.01	-31
11/13/2008	EC-LG	30	R	39.69	360	3.00	575	-215	3.75	-0.75	-1.01	-31
10/14/2008	EC-LG	32	R	179.98	2490	12.00	575	1,915	3.75	8.25	11.06	345
9/12/2008	EC-LG	30	R	225.57	3395	12.00	575	2,820	3.75	8.25	11.06	345
8/13/2008	EC-LG	29	R	223.65	3137	12.00	575	2,562	3.75	8.25	11.06	345
7/15/2008	EC-LG	32	R	212.19	2850	12.00	575	2,275	3.75	8.25	11.06	345
6/13/2008	EC-LG	30		50.43	508	11.00	575	-67	3.75	7.25	9.72	303
5/14/2008	EC-LG	29	V	61.72	725	4.00	575	150	3.75	0.25	0.34	10
4/15/2008	EC-LG	32	V	56.64	650	2.00	575	75	3.75	-1.75	-2.35	-73
3/14/2008	EC-LG	30		55.16	650	3.00	575	75	3.75	-0.75	-1.01	-31
2/13/2008	EC-LG	29		53.86	650	2.00	575	75	3.75	-1.75	-2.35	-73
1/15/2008	EC-LG	32	E	53.86	650	2.00	575	75	3.75	-1.75	-2.35	-73
12/14/2007	EC-LG	30		53.86	650	2.00	451	199	3.13	-1.13	-1.51	-47
11/14/2007	EC-LG	30	V	34.5	348	3.00	451	-103	3.13	-0.13	-0.17	-5
10/15/2007	EC-LG	32		110.23	1529	13.00	451	1,078	3.13	9.88	13.24	413
9/13/2007	EC-LG	30	R	199.45	3648	15.00	451	3,197	3.13	11.88	15.92	496
8/14/2007	EC-SG	29	R	234.88	3035	13.00	451	2,584	3.13	9.88	13.24	413
7/16/2007	EC-SG	32	R	218.05	2816	13.00	451	2,365	3.13	9.88	13.24	413
6/14/2007	EC-SG	30	S	241.54	3450	6.00	451	2,999	3.13	2.88	3.86	120
5/15/2007	EC-SG	29	R	13.74	155	2.00	451	-296	3.13	-1.13	-1.51	-47
4/16/2007	EC-SG	32		69.74	1052	6.00	451	601	3.13	2.88	3.86	120
3/15/2007	EC-SG	30		13.74	155	2.00	451	-296	3.13	-1.13	-1.51	-47
2/13/2007	EC-SG	28		13.12	145	2.00	451	-306	3.13	-1.13	-1.51	-47
1/16/2007	EC-SG	33	L	44.64	650	2.00	451	199	3.13	-1.13	-1.51	-47
12/14/2006	EC-SG	30		44.64	650	0.00	575	75	2.14	-2.14	-2.87	-90

11/14/2006	EC-SG	32	E	44.64	650	2.00	575	75	2.14	-0.14	-0.19	-6
10/13/2006	EC-SG	30	R	125.55	1946	12.00	575	1,371	2.14	9.86	13.22	412
9/13/2006	EC-SG	30	E	110.09	1600	12.00	575	1,025	2.14	9.86	13.22	412
8/14/2006	EC-SG	31	R	124.21	1733	12.00	575	1,158	2.14	9.86	13.22	412
7/14/2006	EC-SG	30	R	117.49	1638	12.00	575	1,063	2.14	9.86	13.22	412
6/14/2006	EC-SG	30	R	110.23	1504	13.00	575	929	2.14	10.86	14.56	454
5/15/2006	EC-SG	31	R	56.04	728	5.00	575	153	2.14	2.86	3.83	119
4/14/2006	EC-SG	30		39.54	500	2.00	575	-75	2.14	-0.14	-0.19	-6
3/15/2006	EC-SG	30	E	39.54	500	2.00	575	-75	2.14	-0.14	-0.19	-6
2/13/2006	EC-SG	31	E	39.54	500	2.00	575	-75	2.14	-0.14	-0.19	-6
1/13/2006	EC-SG	31	E	39.54	500	2.00	575	-75	2.14	-0.14	-0.19	-6
12/13/2005	EC-SG	32	R	47.71	613	2.00	452	161	3.29	-1.29	-1.72	-54
11/11/2005	EC-SG	29	R	21.44	250	2.00	452	-202	3.29	-1.29	-1.72	-54
10/13/2005	EC-SG	30	R	140.78	1899	14.00	452	1,447	3.29	10.71	14.37	448
9/13/2005	EC-SG	32	R	139.83	1786	14.00	452	1,334	3.29	10.71	14.37	448
8/12/2005	EC-SG	29	R	110.93	1366	14.00	452	914	3.29	10.71	14.37	448
7/14/2005	EC-SG	30	E	202.28	2500	13.00	452	2,048	3.29	9.71	13.03	406
6/14/2005	EC-SG	32	R	99.87	1336	13.00	452	884	3.29	9.71	13.03	406
5/13/2005	EC-SG	29	R	21.05	264	14.00	452	-188	3.29	10.71	14.37	448
4/14/2005	EC-SG	17		39.25	539	2.00	452	87	3.29	-1.29	-1.72	-54
3/28/2005	EC-SG	27	S	40.29	550	1.00	452	98	3.29	-2.29	-3.07	-95
3/1/2005	EC-SG	32		43.66	600	1.00	452	148	3.29	-2.29	-3.07	-95
1/28/2005	EC-SG	30		26.84	350	1.00	452	-102	3.29	-2.29	-3.07	-95
12/29/2004	EC-SG	30	E	30.2	400	2.00	410	-10	1.60	0.40	0.54	17
11/29/2004	EC-SG	32	R	34.91	470	2.00	410	60	1.60	0.40	0.54	17
10/28/2004	EC-SG	30	R	81.39	1161	12.00	410	751	1.60	10.40	13.95	434
9/28/2004	EC-SG	32		223.29	3229	13.00	410	2,819	1.60	11.40	15.29	476
8/27/2004	EC-SG	29		193.03	2561	13.00	410	2,151	1.60	11.40	15.29	476
7/29/2004	EC-SG	30		187.57	2500	13.00	410	2,090	1.60	11.40	15.29	476
6/29/2004	EC-SG	32		174.59	2343	12.00	410	1,933	1.60	10.40	13.95	434
5/28/2004	EC-SG	29		106.41	1518	12.00	410	1,108	1.60	10.40	13.95	434
4/29/2004	EC-SG	29	R	18.18	229	1.00	410	-181	1.60	-0.60	-0.80	-25
3/31/2004	EC-SG	30	R	28.31	377	1.00	410	-33	1.60	-0.60	-0.80	-25
1/3/2004	EC-SG	32	R	41.79	574	2.00	410	164	1.60	0.40	0.54	17

10,852

PCC Statistical Summary

Min:	261.1
Avg:	395.1
Max:	496.1
St. Dev.:	53.0
RSD:	13.4%