

Memorandum

To: Misty Mount
From: Marci Pape, P.E.
Date: 2/28/06
Re: Diversion Rate Analysis for Inouye Right No. 03-04010

I have completed the diversion rate analysis for Water Right 03-04010. Below is a summary of the information on which I based my analysis, any assumptions that were made, and the results of my analysis. For 50.3 acres, the total field irrigation requirement would be **1.94 cfs**, or 0.039 cfs/ac.

CALCULATIONS

For the place of use, I used a POU shapefile supplied by IDWR, consisting of two fields covering a total of 50.3 acres. The fields are irrigated using furrows with row spacings of 3.5 feet, based on the questionnaire received from Mr. Inouye. In our phone conversation on February 25, 2006, Mr. Inouye confirmed that the furrows run in an east-west direction, with Field A flowing to the west and Field B flowing to the east.

Furrow slope was another subject discussed with Mr. Inouye on February 25. In his questionnaire, he gave a field slope of 3%. Upon examination of 1:24000 digital topographic maps in ArcView, I found slopes that appeared to be much flatter. When asked about the slopes over the phone, Mr. Inouye corrected the slope estimates to "more like 1%", which is consistent with the slopes I calculated and is the value I subsequently used for my analysis.

Both Field A and Field B were analyzed using onions, based on the information provided by Mr. Inouye. The rooting depth and percent available moisture I used were those suggested in Figure A-6 of the "Guidelines for the Evaluation of Irrigation Diversion Rates", prepared in October of 1991 by Hubble Engineering, Inc. and Associated Earth Sciences, Inc.

The soil types were determined using the soils information from the USDA, NRCS for Payette County, Idaho. The dominant soil on the property is Baldock Silt Loam. Another soil, Bowman Loam has an insignificant presence on the property, so it was not analyzed.

The weather station nearest to this site is the Payette station. The 80th percentile monthly ET values from that weather station were used for my analysis.

RESULTS

Field application efficiencies of 35% for Field A and 34% for Field B were calculated. The management allowed deficit (MAD), equivalent to the net irrigation application, was found to be 0.78 inches. The resulting flow rates per acre were 0.038 cfs/ac for Field A and 0.039 cfs/ac for Field B.

February 28, 2006

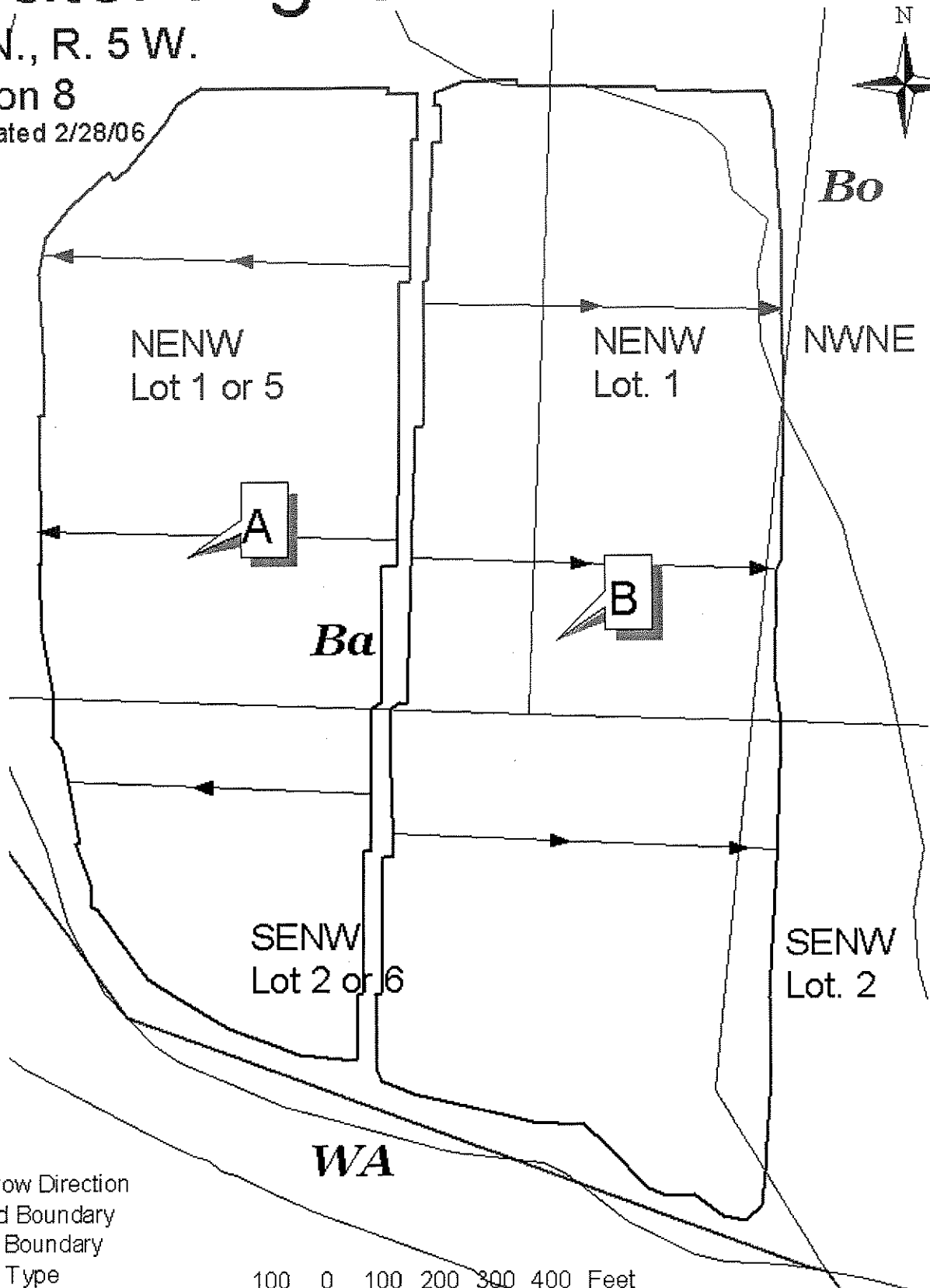
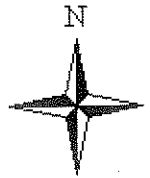
The Total On-Farm Irrigation Requirement for A03-04010 was determined to be **1.94 cfs for 50.3 acres**. This is strictly the on-farm diversion requirement, with no allowance made for conveyance loss. It appears that the only ditch used for the delivery of water to the fields is the head ditch from which the furrows feed, making a conveyance loss calculation unnecessary.

Water Right No. 03-04010

T. 8 N., R. 5 W.

Section 8

Map created 2/28/06



- Furrow Direction
- Field Boundary
- Soil Boundary
- Ba* Soil Type
- Township Line
- Quarter-Quarter Line

100 0 100 200 300 400 Feet

IRRIGATION DIVERSION RATE ANALYSIS

CLAIM NO(S): 3-04010
FIELD ID NO: A
TOTAL ACRES: 21.6 AC
FIELD SLOPE: 1.0 %
FURROW LENGTH: 600 FT

ANALYSIS COMPLETED BY:	MARCI PAPE
DATE OF ANALYSIS:	02/27/06
Qmax PER FURROW:	Qmin PER FURROW:
For corrugates: 10.0 gpm	For both: 3.0 gpm
For furrows: 10.0 gpm	

[illegible]

TOTAL AC	TOTAL %	CFS/AC FOR
21.6	100	EACH CROP: 0.038

TOTAL CFS FOR FIELD: 0.82

FIELD ID NO:	B
TOTAL ACRES:	28.7 AC
FIELD SLOPE:	1.0 %
FURROW LENGTH:	650 FT

DATE OF ANALYSIS:		02/27/06	
Qmax PER FURROW:		Qmin PER FURROW:	
For corrugates:	10.0 gpm	For both:	3.0 gpm
For furrows:	10.0 gpm		

[illegible]

TOTAL AC	TOTAL %	CFS/AC FOR EACH CROP:
28.7	100	0.039

TOTAL CFS FOR FIELD: 1.12

Total On-Field Irrigation Req_t. = $0.82 + 1.12 = \underline{1.94 \text{ cfs}}$

FIELD IRRIGATION REQUIREMENT

initials: MP Claimant = SI & JI FAMILY LLC - Field A - 1% slope

date: 02/23/06 Weather Station = Payette

crop	acres	irrig. system	eff. (%)	Monthly ET (mm/day)					AVE IR season (mm/yr)		net irrig. app. (in)	ET ratio	irrig. freq. (days)	Gross Irrigation Application (peak period ET/eff. in mm/day)					season oct (mm/yr)
				mar	apr	may	jun	jul	aug	sep				oct	apr	may	jun	jul	
onions	21.6	fur	35	1.63	3.3	5.47	7.05	6.03	4.46	0.78	1.14	2.5	5.31	10.75	17.82	22.96	19.64	14.53	

Summary 21.6

Peak Gross Irrigation Application (mm/day) = 22.96
 On-Farm Irrigation Requirement (cfs/acre) = 0.038
 Total On-Farm Irrigation Requirement (cfs) = 0.82
 Irrigation Diversion Volume (ft/yr) = 0.00
 Total Irrigation Diversion Volume (ac-ft/yr) = 0

5.31 10.75 17.82 22.96 19.64 14.53

FIELD IRRIGATION REQUIREMENT

initials: MF Claimant = SI & JI FAMILY LLC - Field B - 1% slope
 date: 02/27/06 Weather Station = Payette

crop	acres	irrig. system	eff. (%)	Monthly ET (mm/day)												net irrig. app. (in)	ET ratio	irrig. freq. (days)	Gross Irrigation Application (peak period ET/eff. in mm/day)												season (mm/yr)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
				mar	apr	may	jun	jul	aug	sep	oct	AVE IR season (mm/yr)	mar	apr	may				jun	jul	aug	sep	oct																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
onions	28.7	fur	34	1.63	3.3	5.47	7.05	6.03	4.46		0.78	1.14	2.5	5.47	11.06	18.34	23.64	20.22	14.95																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																</

Summary 28.7

Peak Gross Irrigation Application (mm/day) = 23.64
 On-Farm Irrigation Requirement (cfs/acre) = 0.039
 Total On-Farm Irrigation Requirement (cfs) = 1.12
 Irrigation Diversion Volume (ft/yr) = 0.00
 Total Irrigation Diversion Volume (ac-ft/yr) = 0

Field A, 12-hour set times, 1.0% slope:

FURROW

Auto

INTAKE FAMILY <If> = 0.55
 DESIGN APPLICATION <Fn> = 0.78 INCHES
 FURROW SLOPE <S> = 0.010 FEET/FOOT
 FURROW SPACING <W> = 3.50 FEET
 FURROW LENGTH <L> = 600 FEET
 INFLOW RATE <Q> = 4.0 GPM/FURROW
 APPLICATION TIME <Ti> = 12 HOURS

 ADVANCE TIME <Tt> = 162.9 MINUTES; OR 2.7 HOURS
 GROSS APPLICATION <FG> = 2.20 INCHES
 NET APPLICATION <Fn> = 1.86 INCHES
 RUNOFF <RO> = 0.07 INCHES
 DEEP PERCOLATION <DP> = 1.35 INCHES
 EFFICIENCY <E> = 35.46 %

TO CHANGE: PRESS (EXISTING)
 Design Application <1> 0.78 in
 Furrow Slope <2> 0.010 ft/ft
 Furrow Spacing <3> 3.50 ft
 Furrow Length <4> 600 ft
 Furrow Intake Family <5> 0.55
 Inflow Rate <6> 4.0 gpm/furrow
 Inflow Time <7> 12 hours <ANALYSIS MODE>

TO PRINT: DATA/WITH HEADING PRESS:<8/9>
 NEW DESIGN PRESS <10>, NEW ANALYSIS PRESS <11>, QUIT PRESS <12>? _

Field B, 12-hour set times, 1.0% slope:

FURROW

Auto

INTAKE FAMILY <If> = 0.55
 DESIGN APPLICATION <Fn> = 0.78 INCHES
 FURROW SLOPE <S> = 0.010 FEET/FOOT
 FURROW SPACING <W> = 3.50 FEET
 FURROW LENGTH <L> = 650 FEET
 INFLOW RATE <Q> = 4.5 GPM/FURROW
 APPLICATION TIME <Ti> = 12 HOURS

 ADVANCE TIME <Tt> = 164.0 MINUTES; OR 2.7 HOURS
 GROSS APPLICATION <FG> = 2.28 INCHES
 NET APPLICATION <Fn> = 1.88 INCHES
 RUNOFF <RO> = 0.12 INCHES
 DEEP PERCOLATION <DP> = 1.38 INCHES
 EFFICIENCY <E> = 34.14 %

TO CHANGE: PRESS (EXISTING)
 Design Application <1> 0.78 in
 Furrow Slope <2> 0.010 ft/ft
 Furrow Spacing <3> 3.50 ft
 Furrow Length <4> 650 ft
 Furrow Intake Family <5> 0.55
 Inflow Rate <6> 4.5 gpm/furrow
 Inflow Time <7> 12 hours <ANALYSIS MODE>

TO PRINT: DATA/WITH HEADING PRESS:<8/9>
 NEW DESIGN PRESS <10>, NEW ANALYSIS PRESS <11>, QUIT PRESS <12>?

SOIL CHARACTERISTICS

initials:

mp

date:

12/12/05

Soil Type = Baldock (Ba)

Source of Soils Data = NRCS website

soil depth (inches)		AWC (in/in)		PH		organic (%)		soil depth (ft)		AWC (inches)		intake family	
lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	flood	furrow
0	11	0.16	0.21	7.9	8.4	1	2	1	2	2.22		1	0.4
11	48	0.16	0.21					2	3	4.44			
48	60	0.09	0.15					3	4	6.66			
								4	5	8.88		alternate	
								5		10.32		method	
												2	0.55

Management Allowed Deficit (MAD)

crop	root depth (ft)	stress point	MAD (inches)
alfalfa (hay or seed)	5	0.5	5.16
corn (field or silage)	4	0.5	4.44
grain (winter or spring)	4	0.5	4.44
pasture (or grass hay)	3	0.5	3.33
other (enter below)			
onions	1	0.35	0.78

Physical Soil Properties

Payette County, Idaho

[Entries under "Erosion Factors--T" apply to the entire profile. Entries under "Wind Erodibility Group" and "Wind Erodibility Index" apply only to the surface layer. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth In	Sand Pct	Silt Pct	Clay Pct	Moist bulk density g/cc	Saturated hydraulic conductivity micro m/sec	Available water capacity In/in	Linear extensi- bility Pct	Organic matter Pct	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
Ba: Baldock	0-11 11-48 48-60	-- -- --	-- -- --	12-22 18-27 5-15	1.20-1.40 1.25-1.40 1.35-1.50	4.00-14.11 4.00-14.11 14.11-42.34	0.16-0.21 0.16-0.21 0.09-0.15	0.0-2.9 0.0-2.9 0.0-2.9	1.0-2.0 0.0-0.5 0.0-0.5	.32 .32 .10	.32 .32 .10	5	4L	86
Bo: Bowman	0-14 14-32 32-60	-- -- --	-- -- --	10-18 10-18 0-3	1.25-1.50 1.50-1.60 1.50-1.75	4.00-14.11 14.11-42.34 141.14	0.17-0.21 0.14-0.18 0.03-0.05	0.0-2.9 0.0-2.9 0.0-2.9	2.0-5.0 1.0-2.0 0.0-0.5	.32 .28 .02	.32 .28 .10	4	4L	86

Engineering Properties

Payette County, Idaho

[Absence of an entry indicates that the data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
<i>In</i> <i>Pct</i>												
Ba: Baldock	0-11	Silt loam	CL, CL-ML, ML	A-4, A-6	0	0	89-100	78-100	69-98	56-81	24-36	7-15
	11-48	Loam, Silt loam	CL, CL-ML	A-4, A-6	0	0	89-100	79-100	71-99	61-86	27-38	12-19
	48-60	Fine sandy loam, Sandy loam	SC-SM, SM	A-2, A-4	0	0	79-100	58-100	50-97	24-51	16-27	2-10
Bo:												
Bowman	0-14	Loam	CL, ML	A-4	0	0	100	100	84-92	58-66	25-40	6-12
	14-32	Fine sandy loam, Loam	ML, SC, SM	A-4	0	0	100	100	89-97	40-48	22-33	6-12
	32-60	Very gravelly coarse sand	GP	A-1	0	0	42-54	22-54	10-26	2-7	0-17	NP-1

Chemical Soil Properties

Payette County, Idaho

[Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	Cation- exchange capacity	Effective cation- exchange capacity	Soil reaction	Calcium carbon- ate	Gypsum	Salinity	Sodium adsorption ratio
	<i>In</i>	<i>meq/100 g</i>	<i>meq/100 g</i>	<i>pH</i>	<i>Pct</i>	<i>Pct</i>	<i>mmhos/cm</i>	
Ba:								
Baldock	0-11	10-20	---	7.9-8.4	15-25	0	2.0-4.0	20-30
	11-48	15-25	---	7.4-9.0	5-15	0	2.0-4.0	10-20
	48-60	5.0-15	---	7.9-8.4	5-15	0	2.0-4.0	0-10
Bo:								
Bowman	0-14	10-25	---	7.4-8.4	0-5	0	0.0-2.0	0-5
	14-32	8.0-20	---	7.4-8.4	0-5	0	0.0-2.0	0-5
	32-60	1.0-3.0	---	6.6-7.8	0	0	0.0	0

80th Percentile Values of Monthly ET (mm/day)

Station: Payette

	ETR	ALFH	ALFS	BEANS	F CRN	SILGE	S CRN	PEAS	POTAT	SBEET	SGRAN	WGRAN	PAST	ORCHD	VEGES	ONION	HOPS
March	AVE ET 2.29		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	1.24	0.79	0.00	0.00	0.00	0.00
March	STDD ET 0.29		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.16	0.10	0.00	0.00	0.00	0.00
March	80PCT ET 2.53	U	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	1.37	0.87	0.00	0.00	0.00	0.00
April	AVE ET 4.78	S	3.74	0.00	0.00	0.00	0.00	1.52	1.44	1.44	1.54	4.54	3.45	2.03	0.00	1.54	1.50
April	STDD ET 0.36	E	0.28	0.00	0.00	0.00	0.00	0.11	0.11	0.11	0.11	0.34	0.26	0.15	0.00	0.11	0.11
April	80PCT ET 5.08	E	3.98	0.00	0.00	0.00	0.00	1.61	1.53	1.53	1.63	4.83	3.67	2.16	0.00	1.63	1.59
May	AVE ET 6.38	T	5.73	1.91	1.91	1.91	1.91	4.27	2.84	1.93	5.02	6.38	4.91	4.03	2.10	3.13	4.47
May	STDD ET 0.41	R	0.37	0.12	0.12	0.12	0.12	0.28	0.17	0.13	0.33	0.41	0.32	0.26	0.14	0.20	0.29
May	80PCT ET 6.73	R	6.04	2.01	2.01	2.01	2.01	4.51	2.78	2.04	5.30	6.73	5.18	4.25	2.22	3.30	4.71
June	AVE ET 8.01	F	6.82	4.05	3.71	3.71	3.79	5.92	6.34	4.23	7.99	8.01	6.16	6.56	4.86	5.25	7.59
June	STDD ET 0.40	O	0.34	0.20	0.18	0.18	0.19	0.30	0.32	0.21	0.40	0.40	0.31	0.33	0.24	0.26	0.38
June	80PCT ET 8.35	R	7.11	4.22	3.86	3.86	3.95	6.17	6.61	4.41	8.33	8.35	6.42	6.84	5.06	5.47	7.91
July	AVE ET 8.77	A	5.30	8.08	8.02	8.02	7.97	2.41	7.24	8.60	7.25	6.19	6.76	7.46	6.97	6.87	8.34
July	STDD ET 0.27	L	0.16	0.25	0.25	0.25	0.25	0.07	0.22	0.27	0.22	0.19	0.21	0.23	0.21	0.21	0.26
July	80PCT ET 9.00	F	5.43	8.29	8.23	8.23	8.18	2.47	7.43	8.83	7.44	6.35	6.94	7.65	7.15	7.05	8.56
August	AVE ET 7.27	A	2.95	3.52	6.66	6.66	6.27	0.00	5.33	7.08	1.48	1.20	5.60	6.18	5.68	5.82	6.90
August	STDD ET 0.31	L	0.13	0.15	0.29	0.29	0.27	0.00	0.23	0.31	0.06	0.05	0.24	0.27	0.25	0.25	0.30
August	80PCT ET 7.53	F	3.06	3.65	6.90	6.90	6.50	0.00	5.52	7.34	1.53	1.24	5.80	6.41	5.89	6.03	7.15
September	AVE ET 5.48	A	1.40	0.58	3.94	3.94	0.00	0.00	2.48	4.65	0.00	0.00	4.22	4.55	3.44	4.24	4.93
September	STDD ET 0.34	H	0.09	0.04	0.24	0.24	0.00	0.00	0.15	0.29	0.00	0.00	0.26	0.28	0.21	0.26	0.30
September	80PCT ET 5.77	A	1.48	0.61	4.14	4.14	0.00	0.00	2.61	4.89	0.00	0.00	4.44	4.79	3.62	4.46	5.18
October	AVE ET 3.21	Y	0.33	0.00	0.86	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.47	2.04	0.00	0.00	0.00
October	STDD ET 0.25		0.03	0.00	0.07	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.19	0.16	0.00	0.00	0.00
October	80PCT ET 3.42		0.36	0.00	0.92	0.00	0.00	0.00	0.00	2.13	0.00	0.00	2.63	2.17	0.00	0.00	0.00

ET and standard deviation data (AVE ET and STDD ET) taken from Appendix E (unpublished) of Brockway, C.E., and R.G. Allen, 1983, Estimating Consumptive Irrigation Requirements for Crops in Idaho, Idaho Water and Energy Resources Research Institute.

80th Percentile ET values (80PCT ET) calculated based on Walpole, R.E., and R.H. Meyers, 1985, third edition, PROBABILITY AND STATISTICS FOR ENGINEERS AND SCIENTISTS, New York: Macmillan Publishing Company, pp. 132-144 and 574.