

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

A. GENERAL INFORMATION

Permit No: 65-13731

Exam Date: 8/24/2012

1. Current Owner: BROOKE L MACICEK
600 E MORELAND DR
ORANGE CA 92866
(714) 614-7866

And

CLARENCE L MACICEK
600 E MOORELAND DR
ORANGE CA 92866
(714) 614-7866

2. Accompanied by: Cody - Renter

Phone No: cell phone 365-8530

Address:

Relationship to Permit Holder: Renter, living on property

3. SOURCE

TRIBUTARY

GROUND WATER

B. OVERLAP REVIEW

1. Other water rights with the same place of use: **None**
2. Other water rights with the same point of diversion: **None**

C. DIVERSION AND DELIVERY SYSTEM

1. LOCATION OF POINT(S) OF DIVERSION: (Two wells)

GROUND WATER NW1/4SW1/4 Sec. 15, Twp 06N, Rge 02W, B.M. GEM County

GROUND WATER NW1/4SW1/4 Sec. 15, Twp 06N, Rge 02W, B.M. GEM County

Method of Determination: GPS location and visual inspection

2.

PLACE OF USE: DOMESTIC

TwpRge Sec	NE				NW				SW				SE				Totals
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
06N02W 15										X							

TwpRge Sec	NE				NW				SW				SE				
	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>Totals</u>
06N02W 15											5.5						5.5

TwpRge Sec	NE				NW				SW				SE				
	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>Totals</u>
06N02W 15										X							

TwpRge Sec	NE				NW				SW				SE				Totals
	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	
06N02W 15											X						

TwpRge Sec	NE				NW				SW				SE				Totals
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
06N02W 15											X						

TwpRge Sec	NE				NW				SW				SE				
	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>Totals</u>
06N02W 15										X							

Method of Determination: **GIS and visual inspection.**

3. ☐_yes_ Delivery System Diagram Attached (required). Indicate all major components and distances between components. Indicate weir size/pipe as applicable.
- ☐_yes_ Map Attached Showing Location(s) of point(s) of diversion and place(s) of use (required). Scale must be 1:24,000 or greater.
- ☐_yes_ Aerial Photo Attached (required for irrigation of 10+ acres).
- ☐_yes_ Photo of Diversion and System Attached

4.

Well or Diversion Identification No.*	Motor Make	Hp	Motor Serial No.	Pump Make	Pump Serial No. or Discharge Size
A0017584	artesian				Irrigation by road
D0020086	artesian				Domestic by house

*Code to correspond with No. on map and aerial photo

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date
5 gal bucket						

2. Measurements: **Flow was determined by filling a 5 gallon bucket three times and averaging the fill rate.**

E. FLOW CALCULATIONS

_____Additional Computation Sheets Attached

Measured Method: 5-gallon bucket and measuring pressure at sprinkler heads.

Irrigation calculations:

Well #1 (A0017584) **irrigation well**

First bucket fill = 17.20 sec.

Second bucket fill = 17.28 sec.

Third bucket fill = 18.81 sec

Average fill rate 17.8 sec.

According to the field examination guidebook, a fill rate of 17.8 seconds equals 18.8 gpm or **0.04 cfs.**

5 gal/17.8 seconds = y gal/60 seconds

y = 16.85 gal per minute

16.85 gpm ÷ 448 = 0.04 cfs

Well # 2 (D0020086) **domestic well**

Two Rainbird sprinklers 3/16" nozzles @ 44 psi.

According to the field examination guidebook, sprinkler system discharge = 14.06 gpm or **0.03 cfs.**

Irrigation 0.04 + 0.03 = 0.07 cfs.

Permit allows for 0.14 cfs, recommend **0.07 cfs** for irrigation.

Commercial calculations: No commercial development located.

Wildlife calculations:

5-gallon bucket fill calculations:

First bucket fill = 46.22 sec.

Second bucket fill = 45.66 sec.

Third bucket fill = 46.19 sec.

Average fill rate 46.02 sec.

According to the field examination guidebook, a fill rate of 46.2 seconds equals **0.01 cfs.**

5 gal/46.2 seconds = y gal/60 seconds

y = 6.49 gal per minute

6.49 gpm ÷ 448 = **0.01 cfs**

Wildlife Storage calculations: N/A

Heating/Cooling calculations:

5-gallon bucket fill calculations:

First bucket fill = 46.22 sec.

Second bucket fill = 45.66 sec.

Third bucket fill = 46.19 sec.

Average fill rate 46.02 sec.

According to the field examination guidebook, a fill rate of 46.2 seconds equals **0.01 cfs.**

5 gal/46.2 seconds = y gal/60 seconds

y = 6.49 gal per minute

6.49 gpm ÷ 448 = **0.01 cfs**

Realtor Sales records indicate the house is 2,838 sq. ft and was built in 1993.

Domestic calculations:

Administrative memo #22 for application processing allows for 0.02 or 0.6 AF for in house use.

Recommend **0.02 cfs.**

Diversion to Storage calculations:

5-gallon bucket fill calculations:

First bucket fill = 46.22 sec.

Second bucket fill = 45.66 sec.

Third bucket fill = 46.19 sec.

Average fill rate 46.02 sec.

According to the field examination guidebook, a fill rate of 46.2 seconds equals **0.01 cfs.**

5 gal/46.2 seconds = y gal/60 seconds

y = 6.49 gal per minute

6.49 gpm ÷ 448 = **0.01 cfs**

F. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation:

$$V_{I.R.} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) = 5.5 \times 4.5 = 24.8 \text{ AF}$$

$$V_{D.R.} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation season}) \times 1.9835 = 0.07 \times 260 \times 1.9835 = 36.1 \text{ AF}$$

$$V = \text{Smaller of } V_{I.R.} \text{ and } V_{D.R.} = 24.8 \text{ AF}$$

2. Volume Calculations for Other Uses:

Pond (Wildlife use)

$$0.01 \text{ cfs} \times 1.9835 \times 365 \text{ days} = 7.2 \text{ AF}$$

Pond (Wildlife Storage):

$$0.7 \text{ acres} \times 1.0 \text{ foot average depth} = 0.7 \text{ AF of storage.}$$

Static ground water level is at the surface so there is zero loss due to seepage.

Evaporation is calculated at 1.89 AFA per UIdaho website (see attached). 1.89 AFA

$$\text{Total storage: } 0.7 + 1.9 = 2.6 \text{ AFA}$$

Heating/Cooling: (See Memorandum dated February 21, 2013 from Michele Edl for calculations)

Maximum capacity = 7.2 AF

Michele Edl's system needs calculated at 10.6 AF

Recommend limiting volume to **7.2 AF.**

Domestic Use:

Administrative memo #22 for application processing allows for 0.02 or 0.6 AF for in house use.

Recommend 0.6 AF.

G. NARRATIVE/REMARKS/COMMENTS

The original owner Mr Guille is no longer available. The property is owned by Mr. and Mrs. Macicek as an investment property. There is a change of ownership in the file. I contacted Mr. Macicek by phone at 714-614-7866 and left a message. He contacted me back and instructed me to talk to his wife at 714-614-7865. I contacted her and asked for information on the property management company handling the rental. She didn't have the information but would get back to me, which she never did. While in the Emmett area doing other exam, I stopped by and met the renter Cody who showed me around. Cody lives there with his girlfriend.

There are two wells on this property, both of which are artesian. The first well was identified by GPS location and marked A0017584. This well is located in the northeast corner of the property and is used for irrigation. There are four facets on the well which allow a 1 or 2 or 3 inch pipe connection for irrigation. There were no pipes connected at the time of the exam. The land around the well was planted in grass but was dry. The Renter said he had hired someone to mow the grass and keep down weeds but was not irrigating except for the grass around the house. Using a 5 gallon bucket, I measured the flow out of the 2 inch facet three times (see calculations attached).

The second well is located by the house and has a Well ID tag D0020086. This well is used to water the lawn around the house and for heating and cooling. The Renter said the water tasted like sulfur and they used it for domestic but drink bottled water. The heat exchanger in the house was being used for cooling. Documentation on the exchanger indicated the maximum rate of flow was 7 gpm. We located the discharge line at the back of the house which was flowing into the wildlife ponds. Using a 5 gallon bucket, we measured the flow three times. Average flow was 6.58 gpm.

This well is also used to water grass around the house using an electric motor to boost pressure with a 2 inch line with two 3/16 inch Rainbird sprinklers. Water pressure at the sprinklers was measured at 44 psi giving a flow rate of 14.06 gpm.

Static water level on this land is at ground level causing standing water at the center west end of the property. The renter indicated the previous renter had excavated one of the ponds to a depth of about 2 feet. The other ponds were less than 6 inches deep, more of a trickle of water running westward from the discharge line for the heat exchanger. The renter indicated mosquitoes were a problem which was verified during the field exam! The area of the ponds calculated using GIS is 0.7 acres. Although the small pond area could be 2 foot deep, the marshy area around the pond is less than 1 inch deep. I'm averaging all pond area at 1.0 foot deep. Wildlife Storage will be calculated as 0.7 acres x 1 foot depth + evaporation per UofI's Kimberly website.

The wildlife use consists of the constant flow of water from the heating/cooling system which was measured at 0.01 cfs. It is possible irrigation runoff could supply water to the pond which could amount to 0.07 cfs for both wells combined. Since the wells are artesian and low pressure, it is believed, supplying the maximum amount of irrigation water would significantly reduce the amount of Domestic/Heating/Cooling water supplied by the well. Therefore, I am limiting the Wildlife flow rate (and Diversion to Storage) to the maximum output of the wells or 0.07 cfs and a volume of 7.2 AF. A condition will be added to the license indicating that when combined, the flow and volume should not exceed these limits.

Domestic Use of water – per Administrative Memo for Application Processing #22, domestic rate for in house use allows for 0.6 AFA or 0.02 cfs.

There was no evidence of commercial use of water on the property. The renter said he doesn't know of any greenhouse or commercial use ever developed. Analysis of aerial photos show no greenhouse or commercial use, therefore commercial use will be dropped. During a meeting with Shelley Keen, Craig Saxton and Dan Nelson on September 27, 2012, we discussed if the commercial use could be changed to cooling to cover the heat exchanger during the summer. There is already a use for Heating. It was thought that with an executive order and amendment, the use of Commercial could be changed to Cooling. We will be contacting the applicant to see if this is acceptable. If not, Cooling will not be added and the applicant will need to apply for a new permit prior to using the system for cooling.

Conditions Comments: Condition "R07 - Return flow discharged to a subsurface system must be authorized by a separate injection well permit" will be dropped at licensing. Since the wells are artesian, no injection is possible unless they drill a new well.

There was one condition on the permit that was split into #132 and the multiple wells in the legal description was removed because the water right now shows two legal diversions that are identical representing the two wells.

Have conditions of permit approval been met? ☒ Yes ☐ No

H. RECOMMENDATIONS

1. Recommended Amounts

<u>BENEFICIAL USE</u>	<u>PERIOD OF USE</u>	<u>DIVERSION RATE</u>	<u>ANNUAL VOLUME</u>
DOMESTIC	01/01 to 12/31	0.020 CFS	0.60 AF
IRRIGATION	03/15 to 11/15	0.070 CFS	24.80 AF
DIVERSION TO STORAGE	01/01 to 12/31	0.070 CFS	
WILDLIFE	01/01 to 12/31	0.010 CFS	7.20 AF
HEATING	01/01 to 12/31	0.010 CFS	7.20 AF
WILDLIFE STORAGE	01/01 to 12/31		2.60 AF
COOLING	01/01 to 12/31	0.010 CFS	7.20 AF
<u>Totals:</u>		0.070 CFS	35.20 AF

2. Recommended Amendments

☐ Change P.D. as reflected above ☐ Add P.D. as reflected above ☐ None

☐ Change P.U. as reflected above ☐ Add P.U. as reflected above ☒ Other

I. AUTHENTICATION

Field Examiner's Name Glen Gardin Date March 6, 2013

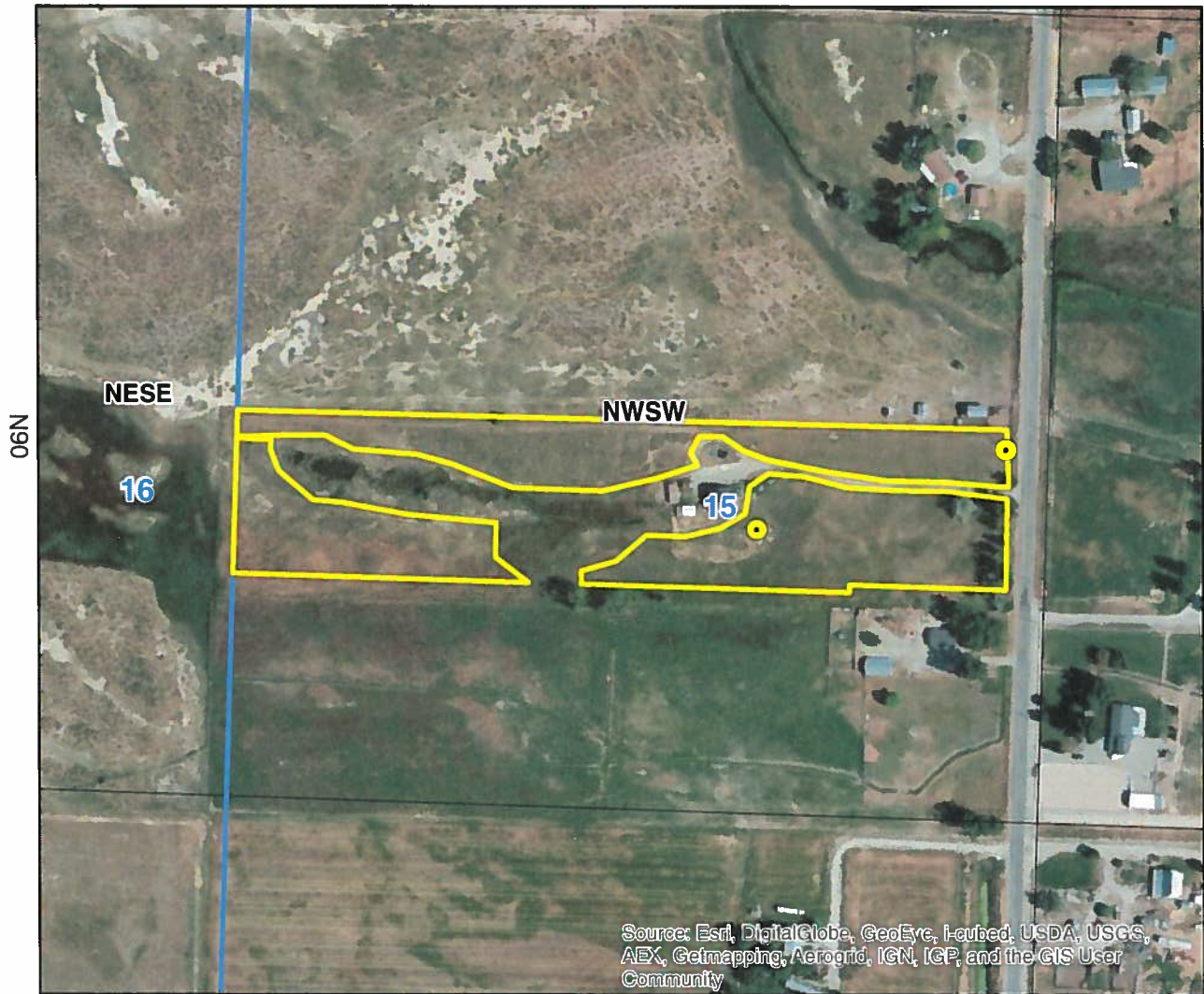
Reviewer _____ Date _____

State of Idaho
Department of Water Resources
Water Right Field Exam

65-13731
Irrigation Use
August 24, 2012

This map depicts the IRRIGATION place of use boundary for this water right at the time of this approval and is attached to the approval document solely for illustrative purposes.

02W



-  Point of Diversion
-  Place Of Use Boundary
-  Townships
-  PLS Sections
-  Quarter Quarters

0 0.035 0.07 0.14 Miles

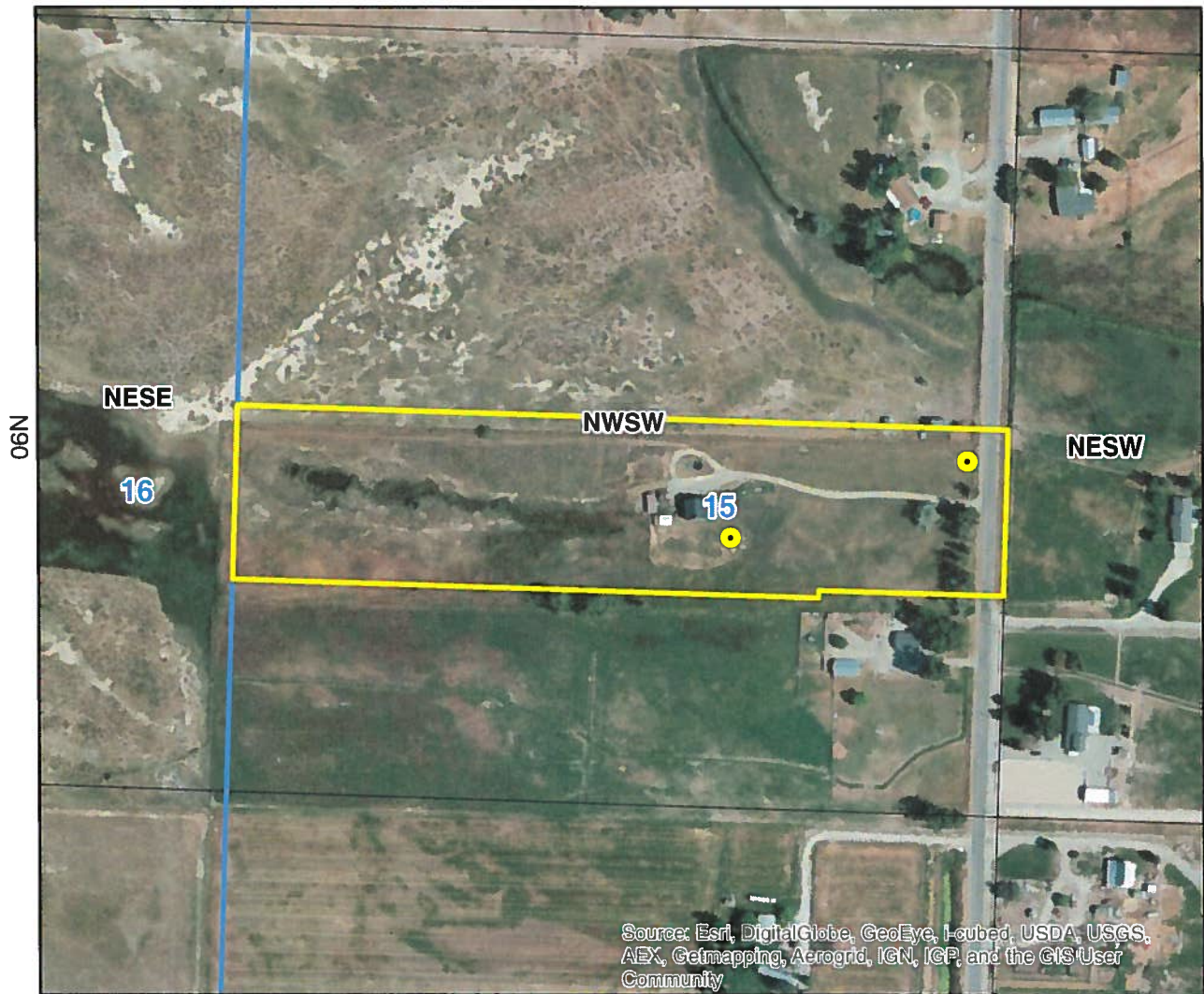


State of Idaho
Department of Water Resources
Water Right Field Exam

65-13731
Domestic, Heating and Cooling Use
August 24, 2012

This map depicts the DOMESTIC, HEATING and COOLING place of use boundary for this water right at the time of this approval and is attached to the approval document solely for illustrative purposes.

02W



-  Point of Diversion
-  Place Of Use Boundary
-  Townships
-  PLS Sections
-  Quarter Quarters

0 0.0375 0.075 0.15 Miles



State of Idaho
Department of Water Resources
Water Right Field Exam

65-13731
August 24, 2012

This map depicts the WILDLIFE and WILDLIFE STORAGE place of use boundary for this water right at the time of this approval and is attached to the approval document solely for illustrative purposes.

02W



- Point of Diversion
- Place Of Use Boundary
- Townships
- PLS Sections
- Quarter Quarters

0 0.0325 0.065 0.13 Miles



Precipitation Loss Calculation

Date: August 29, 2012
Prepared by: Glen Gardiner
Water Right No: 65-13731

P = Precipitation
ET = Evapotranspiration
 P_d = Precipitation deficit
 P_d = P - ET

P_d

Found at: <http://www.kimberly.uidaho.edu/ETIdaho/>

P_d = convert to AFA: (mm/yr) / (convert to feet) x # acres =

824		304.8		0.7	
(From ET Idaho)					

P_d = 1.89 AFA

* Use the Precipitation Deficit for 'P' value

ET_{Idaho} 2012 -- Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho

Please send suggestions for improving this site to robison@kimberly.uidaho.edu Copyright 2012, University of Idaho.

Emmett 2 E (NWS -- 102942)

Statistics based on thirty year normal spans 1970 to 2010 years

For a different land cover or crop click on the above link.

You can highlight this table and copy via the clipboard to a Microsoft Excel or OpenOffice spreadsheet to plot or otherwise work with this data.

Open water - shallow systems (ponds, streams)														
Actual Evapotranspiration (Click here for a graph)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Growing Season ^a	Non Growing Season ^b
Mean ^j	mm/day												mm	
Monthly ^c	0.34	0.84	1.81	2.85	3.65	4.06	4.29	3.75	2.69	1.70	0.70	0.32	824	0
15-Day Moving Average ^d	0.33	0.83	1.84	2.83	3.67	4.05	4.31	3.75	2.65	1.72	0.68	0.31		
7-Day Moving Average ^e	0.34	0.83	1.83	2.84	3.65	4.05	4.31	3.75	2.66	1.71	0.69	0.31		
3-Day Moving Average ^f	0.34	0.84	1.81	2.85	3.65	4.05	4.30	3.75	2.68	1.70	0.69	0.32		
Standard Deviation ^k	mm/day												mm	
Monthly ^c	0.09	0.13	0.33	0.31	0.55	0.28	0.36	0.35	0.18	0.22	0.10	0.06	31	0
15-Day Moving Average ^d	0.08	0.19	0.31	0.37	0.52	0.40	0.29	0.34	0.32	0.25	0.15	0.06		
7-Day Moving Average ^e	0.11	0.26	0.40	0.50	0.66	0.58	0.35	0.45	0.44	0.36	0.20	0.09		
3-Day Moving Average ^f	0.14	0.32	0.51	0.67	0.83	0.75	0.49	0.54	0.56	0.44	0.24	0.13		
20% Exceedance ^l	mm/day												mm	
Monthly ^c	0.38	0.93	1.98	3.06	3.94	4.27	4.50	3.94	2.77	1.76	0.79	0.35	848	0
15-Day Moving Average ^d	0.46	1.15	2.41	3.42	4.49	4.68	4.68	4.26	3.18	2.17	0.94	0.41		
7-Day Moving Average ^e	0.54	1.40	2.55	3.94	4.86	4.99	4.89	4.48	3.45	2.43	1.10	0.51		
3-Day Moving Average ^f	0.64	1.60	2.94	4.43	5.38	5.37	5.25	4.73	3.84	2.69	1.30	0.62		

80% Exceedance ^m	mm/day												mm		
Monthly ^c	0.29	0.71	1.62	2.64	3.26	3.72	4.02	3.49	2.61	1.61	0.59	0.28	801	0	801
15-Day Moving Average ^d	0.22	0.56	1.36	2.21	2.86	3.46	3.87	3.04	2.13	1.28	0.48	0.21			
7-Day Moving Average ^e	0.14	0.40	1.10	1.96	2.48	2.92	3.59	2.87	1.88	1.02	0.34	0.13			
3-Day Moving Average ^f	0.07	0.26	0.86	1.61	2.09	2.34	3.01	2.26	1.55	0.84	0.26	0.06			
Ave Highest ET_{act}	mm/day												--		
15-Day Moving Average ^g	0.40	1.02	2.13	3.17	4.05	4.43	4.49	4.05	3.00	1.99	0.84	0.38			
7-Day Moving Average ^h	0.48	1.21	2.36	3.58	4.55	4.78	4.70	4.28	3.28	2.18	0.99	0.46			
3-Day Moving Average ⁱ	0.58	1.37	2.73	4.07	4.98	5.18	5.00	4.53	3.59	2.40	1.15	0.56			
Ave Lowest ET_{act}	mm/day												--		
15-Day Moving Average ^g	0.27	0.66	1.53	2.49	3.29	3.68	4.11	3.44	2.33	1.42	0.55	0.25			
7-Day Moving Average ^h	0.20	0.53	1.29	2.18	2.84	3.22	3.87	3.22	2.07	1.22	0.45	0.19			
3-Day Moving Average ⁱ	0.14	0.40	1.06	1.86	2.38	2.72	3.40	2.81	1.75	1.03	0.36	0.12			
Special normal distribution parameters for monthly, seasonal, and annual intervals															
Skew ^m	0.01	0.51	0.15	1.20	-0.06	0.52	0.30	0.08	0.74	0.33	0.57	0.08	-0.54	0.00	-0.54
Kurtosis ^o	0.80	3.75	0.59	4.46	0.63	2.94	0.99	0.63	5.22	1.17	2.80	0.80	3.39	0.00	3.39

^a Growing Season: This is usually the time from green up or planting in the spring to a killing frost or harvest in the fall. It is not applicable for entries without a growing season and will be blank.

^b Nongrowing Season: This is usually the time from a killing frost or harvest in the fall to the of green up in the spring. It is not applicable for entries without a growing season.

^c Mean of the average daily value for month

^d Mean of the fourteen 15-day period averages contained in the month

^e Mean of the twenty three 7-day period averages contained in the month

^f Mean of the twenty seven 3-day period averages contained in the month

^g Mean of the highest/lowest 15-day period average in month

^h Mean of the highest/lowest 7-day period average in month

ⁱ Mean of the highest/lowest 3-day period average in month

^j This value represents the *mean value* for the parameter for the month over the 'normal' period of record. Generally, the 'normal' period is the last thirty years with data.

^k This value represents the *standard deviation* for the parameter for the month over the 'normal' period.

^l This value represents the *value* for the parameter that has a 20% chance of being exceeded that month during any particular year. Conversely, there is an 80% chance that the parameter value will be less than the *value* shown.

^m This value represents the *value* for the parameter that has a 80% chance of being exceeded that month during any particular year. Conversely, there is an 20% chance that the parameter value will be less than the *value* shown.

ⁿ This value represents the *skewness (asymmetry) of the distribution of the parameter values* for the month (year) over the 'normal' period. A value near zero indicates that the distribution approximates a normal (Gaussian) and symmetrical distribution. A negative skew indicates that the parameter distribution has relatively few low values compared to high values. A positive skew indicates that the distribution has relatively few high values compared to the number of low values. A skew value near 1 indicates that the underlying distribution approximates a lognormal distribution.

^o This value represents the *kurtosis* of the parameter value distribution for the month (year) over the 'normal' period. Kurtosis is a measurement of the height to width ratio of the probability distribution, or the *peakedness (slenderness)*. A normal (Gaussian) distribution has a kurtosis of 3. A high kurtosis distribution has a sharper peak and longer tails, while a low kurtosis distribution has a more rounded peak and shorter tails.

This work and report were prepared by the University of Idaho Research and Extension Center at Kimberly, Idaho under contract with the Idaho Department of Water Resources. Work was supported by funding from IDWR and the Idaho Agricultural Experiment Station and Idaho Engineering Experiment Station. The authors gratefully acknowledge the long-term evapotranspiration data collection and long-standing advice provided by Dr. James L. Wright, USDA-ARS Kimberly (ret.), the more than two decades of high quality agricultural weather data collection by the U.S. Bureau of Reclamation AgriMet system, and the very long-standing, routine data collection by the hundreds of cooperative weather station volunteers across the state who, for more than one-hundred years, have faithfully observed daily air temperature and precipitation.

The citation for the evapotranspiration data used from this site should be: *Allen, Richard G. and Clarence W. Robison, 2012. Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho: Supplement updating the Time Series through December 2008, Research Technical Completion Report, Kimberly Research and Extension Center, University of Idaho, Moscow, ID.*

Questions regarding the data should be addressed to [Clarence W. Robison](#) or [Richard G. Allen](#), University of Idaho, Kimberly Research and Extension Center, 3793 North 3600 East, Kimberly, ID 83341. Telephone (208)-423-6610

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PHOTOGRAPHER AND DATE OF PHOTOS Glen Gardiner 24-Aug-2012

FILE NUMBER 65-13731



This is a photo of the irrigation well and distribution facets. The fourth facet is a 2 inch at the lower left. You can just make out the red on/off valve.



This is a photo of the domestic well by the house. The electric pump adds pressure for irrigating grass around the house.



This photo shows grass around the house.

PHOTOGRAPHER AND DATE OF PHOTOS Glen Gardiner 24-Aug-2012

FILE NUMBER 65-13731



Photo of discharge from the HVAC system.



Standing surface water below HVAC discharge pipe. Photo taken looking west.

PHOTOGRAPHER AND DATE OF PHOTOS Glen Gardiner 24-Aug-2012

FILE NUMBER 65-13731



Photo of marsh area at west end of property. Photo taken looking west.



Photo of west end of property. Ponds are on the right. Photo taken looking east.

PHOTOGRAPHER AND DATE OF PHOTOS Glen Gardiner 24-Aug-2012

FILE NUMBER 65-13731



Photo of east end of property. Irrigation well is at northeast corner of property, by power pole. Power goes to neighbors barn, well is artesian.

MEMORANDUM

Date: February 21, 2013
To: Water Right File 65-13731
From: Michele Edl
Re: heating/cooling recommendations

I was asked to review the field examiner's report, and to make licensing rate and volume recommendations for the heating and cooling uses. This memo provides my recommendations, and documents the logic and references I used to arrive at those recommendations.

The climate controlled space consists of a 2838 square foot, 2-story residence. The single family home was constructed in 1992. Space heating and cooling is accomplished through the use of a ground source (aka geothermal) heat pump system. The system is an open-loop configuration. There is no isolation heat exchanger and no pump. The source water is approximately 54 degrees F (see the Mauerhan well log) and originates from an artesian well. The heating and cooling system share a well and some diversion piping with the domestic use. An excavated pond on the property accepts the heat pump system discharge.

Heat transfer rate

The examiner made flow measurements but no temperatures were recorded during his August 2012 site visit. Without temperature readings it is more difficult to know that either a cooling or heating use occurred. However, the examiner found that a ground water-sourced heat pump, model # LTV-30-1, was installed and was functioning. Often heat pump model numbers can be decoded to guess at the BTU/hr that the heat pump will deliver. In this case, the 30 in the model number may mean 30,000 BTU/hr or 2.5 tons in cooling. I assumed that the heat pump was capable of transferring 30,000 BTU/hr of heat to or from the water.

A heat pump this size is smaller than the cooling memo predicts for a 2800+ square foot home. However, a smaller heat pump is compatible with the flow rate measured during the field examination. The examiner measured the flow through the heat pump system was approximately 6.6 gpm. He also recorded the rated maximum for the heat pump as 7 gpm at 6 psi.

Based on the Kavanaugh spreadsheet tables for standard homes or the Sterling graph for an average house in Idaho, the design or peak heating load for this home is estimated at 36 - 40 BTU/hr-square foot. A 30,000 BTU/hr heat pump can only deliver 10.6 BTU/hr-square foot. (The calculation is: 30,000 BTU/hr ÷ 2838 square feet). Therefore I estimate that this heat pump system could not comfortably deliver the heat required to meet the peak heating load. It could provide adequate heat for much of the heating season but it could not satisfy the heating requirement for the coldest days. It's likely that a portion of the heating is provided by a separate source.

Rate recommendations

This system operates on a constant artesian pressure. There isn't a cooling rate and a different heating rate. Therefore, I recommend 6.58 gpm or 0.01 cfs as the rate for heating and 0.01 cfs as the rate for cooling. And I recommend that their combined rate equal 0.01 cfs.

Volume Recommendations

The volume of water beneficially used through this system is not available from a totalizing meter. I rely on mathematical calculations to estimate a volume based on the heat transfer rate.

I calculated the heating use volume based on an adaptation of an ASHRAE heating degree day, (HDD) energy estimation method. I used the HDD from the nearest station, Emmett 2E, Idaho (Co-op #102942) for 1982, the coolest year in the period-of-record. I calculated the volume of water that could be beneficially used for space heating using the following equation:

$$\text{Vol} = (\text{HL} \times \text{HDD} \times 24 \times \text{Cd}) / (\text{deltaT1} \times k \times C \times \text{deltaT2}), \text{ where}$$

- HL = 40 BTU/hr/ft² a rate based on Dr. Steve Kavanaugh's spreadsheet
- HDD = 6526 (1982 data, the Base 65 F maximum HDD from Emmett 2E (co-op station #102942))
- 24 = 24 hr/day
- Cd = 0.6 (factor to account for the construction standard)
- deltaT1 = 63 F (design indoor temperature minus design outdoor temperature for Boise)
- k = 0.9 (factor to account for losses)
- C = 2.72 x 10⁶ BTU/AF- F (constant to correct for units)
- deltaT2 = 10 F (temperature of incoming water, assumed to be 54 F, minus temperature of outgoing water, assumed to be 44 F)

My calculation of the volume of water for space heating is: 6.92 AF. See attached spreadsheet.

The cooling volume is estimated from the tables and calculations in imbedded the Kavanaugh spreadsheet. My estimate of the volume of water for space cooling is 1.15 AF. See attached portion of Dr. Kavanaugh's spreadsheet.

The domestic use and the heating/cooling uses appear to share the same well and diversion piping. If that common diversion flowed continuously at 6.58 gpm., the rate measured by the examiner, then it could supply only 10.61 AF per year to be divided among the three uses. My volume recommendation for space heating and cooling uses total 8.05 AF. The remaining 2.56 AF is less than the Department's accepted standard for domestic use. Therefore, the combined volume for the three uses, appear to be limited by the system to 10.61 AF.

I recommend that the heating, cooling and domestic uses be limited to 10.61 AFA for the license.

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

[illegible]

Sterling Method										V=(HL*DD*24* Cd)/(deltaT1*K*C*deltaT2)									
Parameter		Explanation																	
V		heat value of the fuel ASHRAE or annual volume Sterling																	
HL		peak heating load in BTU/hr								HDD 1982 Emmett 2E (station 102942) 6526									
DD		annual heating degree days								usually 65 deg F Base avg xtreme mln -0.76									
24		24 hrs/day								9 based on Manual J and Boise WSO design									
Cd		correction factor, for standard construction choose from ASHRAE fig 1																	
deltaT1		design indoor temp minus design outdoor temp								delta T1= 63 for heating DD in range 4000-7000, Cd = 0.6 72 = design inside									
k		correction factor to account for losses. Use .90								.9 is a fully-condensing boiler									
C		constant to correct for units								for Volume in Af use C =2.72x10^6 BTU/Af-deg F									
deltaT2		temp of incoming geothermal water minus temp of outgoing								delta T2= 10 54 = well water temp 44 = estimated spent water temp									
Area of floor space		liveable floor space in ft ^2 given by assessor								2838									
Geo-Heat gives 5-20 BTU/hr per square ft of floor space																			
Admin memo 23 suggests range 25-75 BTU/hr-sq-ft.																			
Suggested Range BTU/hr-ft^2		HL(BTU/hr) design or peak heating load								HDD									
5		14190	6526	24	0.6	63	0.9	2720000	10										
10		28380	6526	24	0.6	63	0.9	2720000	10										
15		42570	6526	24	0.6	63	0.9	2720000	10										
20		56760	6526	24	0.6	63	0.9	2720000	10										
25		70950	6526	24	0.6	63	0.9	2720000	10										
30		85140	6526	24	0.6	63	0.9	2720000	10										
35		99330	6526	24	0.6	63	0.9	2720000	10										
36		102,168.00	6526	24	0.6	63	0.9	2720000	10										
40		113520	6526	24	0.6	63	0.9	2720000	10										
45		127710	6526	24	0.6	63	0.9	2720000	10										
50		141900	6526	24	0.6	63	0.9	2720000	10										
55		156090	6526	24	0.6	63	0.9	2720000	10										
60		170280	6526	24	0.6	63	0.9	2720000	10										
65		184470	6526	24	0.6	63	0.9	2720000	10										
70		198660	6526	24	0.6	63	0.9	2720000	10										
Range of calculated results																			
V (Af)/yr		V= (HL x DD x24 x Cd)/(delta1 x K x C x delta2)																	
0.8646493																			
1.729298599		floor ft^2= 2824 Musgrove extrapolation/realty check																	
2.593947899		BTU= 91615 x 11489																	
3.458597199		BTU x = 372,721.22																	
4.323246499																			
5.187895798																			
6.052545098																			
6.917194398																			
7.781843697																			
8.646492997																			
9.511142297																			

Heating, Water Heating and Cooling Energy, Cost and Carbon Dioxide Estimator

Heating Cost Estimator

Fuel Type	Cost/Unit	Units	¢/kBtu (site)	FloorArea	2838 ft ²	Read Me	GPMpTonH	6.58	Gal/min
Electric	12	¢/kWh	3.52	HeatLoss	kBtu/h		GPMpTonC	6.58	Gal/min
NaturalGas	\$1.60	\$/therm	1.55	HeatSqFt	40 kBtu/h-ft ² →		Heating	3734808	Gal/year
Propane	\$2.50	\$/gal	2.74	HeatReqd	113.5 kBtu/h		Cooling	373481	Gal/year
HeatingOil	\$3.00	\$/gal	2.14	HeatHours	1000 Hours/year		Total	4108289	Gal/year
Wood	\$200.00	\$/cord	1.00					549236	Cu.Ft./year
FYI - Unit Energy Cost Comparison to Gasoline									
Gasoline	\$3.00	\$/gal	=	2.46				12.609	AcreFt/year

			Fan TSP	kW	kWh	Fuel Units	Electric	Fuel	Total
Electric Furnace	COP	1	Included in COP	33.27	33,271		\$3,992.50		\$3,992.50
Air Heat Pump	HSPF	5.5 Btu/W-hr	Included in HSPF	20.64	20,640		\$2,476.80		\$2,476.80
Ground Heat Pump	COP	3.7 Watt/Watt	Included in COP	8.99	8,992		\$1,079.05		\$1,079.05
Natural Gas	AFUEng	80 %	1 in. of water	0.53	528	1135	\$63.33	\$2,270.40	\$2,333.73
Propane	AFUEpro	80 %	1 in. of water	0.53	528	1245	\$63.33	\$3,889.80	\$3,953.13
Oil	AFUEoil	80 %	1 in. of water	0.53	528	811	\$63.33	\$3,040.71	\$3,104.04
Wood Stove	Efficiency	60 %	0.5 in. of water	0.26	264	5.7	\$31.66	\$1,892.00	\$1,923.66

HeatHours Estimates			
Region		Low	High
South	House	600	800
	School	200	400
	Office	200	700
Mid-USA	House	800	1000
	School	300	500
	Office	700	900
North	House	1000	1500
	School	500	600
	Office	900	1100

HeatSqFt Estimates (kBtu/h per 1000 ft ² of Floor Area)					
Region		Poor Quality	Std. Quality	Hi. Quality	Super Eff.
South	House	30	20	15	10
	School	30	22	15	10
	Office	22	18	14	11
Mid-USA	House	40	32	25	16
	School	35	27	20	13
	Office	25	22	15	12
North	House	50	40	30	20
	School	40	30	25	15
	Office	30	24	18	13

Water Heating Cost Estimator

ColdWtrTin	60 °F	Electric	Standby Loss	Distrib. Loss	AFUE/COP	kWh/Fuel Use	Annual Cost	Additional Info Needed for Heat Recovery		
HotWtrTout	120 °F	Nat Gas	10%	10%	1	3862	\$504.61			
GalperDay	60 Gal/day	Propane	10%	10%	65%	204	\$326.01	CoolMonths	HeatMonths	HeatPumpType
kBtuPerDay	30.0 kBtu/Day	Heating Oil	10%	10%	65%	223	\$558.54			
		HeatPump WH	10%	10%	2	1941	\$252.31			
A.K.A Desuperheater→ ElectricWithHeatRecovery			10%	10%	4.23	918	\$119.25	HiUnitCOP	1.61	

Cooling Cost Estimator

Cooling Electric Rate	Cost/Unit	Units	HeatGain	kBtu/h	Annual Cooling Cost	Optional Pumps for Chilled Water and Chilled Water			
ElectricSum	14	¢/kWh	CoolSqFt	20 kBtu/h-ft ² →					
			CoolReqd	56.8 kBtu/h		Head (ft.)	gpm/ton	kW	
			CoolHours	2000 Hours/year					
Supply Fan TSP									
Air Source AC or HP ¹	AvgEERAS	11 Btu/W-hr	Included in EER		5.16	1,032	\$144.48		
Ground Source HP ²	AvgEERGS	14 Btu/W-hr	Included in EER		4.05	811	\$113.52		
Chillers ³	kWperTon	0.7 kW/ton	3 in. of water		5.46	1,093	\$153.00	50	2.4

CoolHours Estimates			
Region		Low	High
South	House	1100	1600
	School	600	1000
	Office	1200	1800
Mid-USA	House	800	1000
	School	400	550
	Office	700	1100
North	House	200	300
	School	200	300
	Office	300	600

CoolSqFt Estimates (kBtu/h per 1000 ft ² of Floor Area)					
Region		Poor Quality	Std. Quality	Hi. Quality	Super Eff.
South	House	32	25	17	10
	School	65	53	36	31
	Office	35	28	20	15
Mid-USA	House	30	22	15	9
	School	60	48	38	28
	Office	30	25	17	14
North	House	28	20	14	8
	School	50	42	30	26
	Office	28	22	16	12

Annual Total	Select Heating, Wtr Heat, Cooling Types	Pounds Carbon Dioxide Produced				ElectCO ₂ kWh	1.35
Heating, Cooling & Water Heating Cost	GroundHeatP Electric&HtRec GroundHeatPump	Annual Heating, Cooling & Water Heating CO ₂	Heat	Water Heat	Cool		
	Heating WaterHeat Cooling		GroundHeatP	Elect&HtRec	GroundHeatPump		
\$1,314	\$1,079 \$119 \$116	14,473	12,139	1,239	1,095		

- The value of Average EER for Air-Source Air-Conditioners and Heat Pumps is used rather than the Seasonal Energy Efficiency Ratio. SEER is based on an indoor temperature of 80°F, an outdoor temperature of 82°F, insufficient fan power requirement, and insufficient moisture removal capability in most climates. These conditions substantially over-predict cooling efficiency. (See "Climatic Impacts on HSPF and SEER for Air-Source Heat Pumps", Fairley, et. al., *ASHRAE Transactions*, Vol. 110, Part 2, 2004.)
- The value of Average EER for Ground Source Heat Pumps is used rather than the Ground Loop Heat Pump (GLHP) Energy Efficiency Ratio. GLHP-EER is based on an indoor temperature of 80.6°F, a ground loop temperature of 77°F, and insufficient fan power requirement. These conditions over-predict cooling efficiency especially in southern climates or when ground loops are poorly installed or under-sized.
- The capacity and electrical demand of chillers does not include the power use of auxiliary equipment and the corresponding heat deduction for distribution of the chilled water and air. This computation includes the power input of the supply fans, chilled water pumps and condenser pumps. It also includes a correction to account for the heat introduced into the system by the supply air handler and chilled water pump. It does not include any penalties if return air fans or fan powered VAV terminals. This can be estimated by adding the total static pressure (TSP) to the supply fan TSP.