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ENGINEERING
P.L.L.C.

Hydraulics

Hydrology

Water Resources

RECEIVED

JAN 19 2005

Department of Water Resources

January 18, 2005

Mr. Shelly Keen
Idaho Department of Water Resources
322. E. Front Street
Boise, Idaho 83720-0098

Re: Permit 37-8365 beneficial use report
Project No. 730-01-204

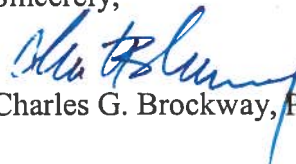
Dear Shelly:

Enclosed is a beneficial use examination for the above-referenced permit. This is the geothermal permit that I spoke with you about a few months ago. I believe you indicated that the Department would welcome any water usage information and/or field report on this well even though the applicant chose to have the Department conduct the exam.

As you will see in the report, the water usage that existed circa 1997 was reconstructed as best as possible using on-ground evidence and discussions with the previous owner. Much evidence still exists on the ground, although the facilities are in disrepair. A calculation of maximum diversion rate requirement was made based on heat transfer calculations for the various system components assuming worst-case climatic conditions.

Please feel free to contact me if you have any questions about this report.

Sincerely,


Charles G. Brockway, P.E.

cc: Jim Speck

CHARLES E.
BROCKWAY,
PH.D., P.E.

CHARLES G.
BROCKWAY,
PH.D., P.E.

2016 NORTH
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TWIN FALLS,
IDAHO 83301

208•736•8543

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STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

RECEIVED

JAN 19 2005

DEPARTMENT OF WATER RESOURCES

A. GENERAL INFORMATION

Permit No.: 37-8365

1. Owner: South Cove Ventures, LLC Phone No.: (208) 726-4421

Current Address: c/o Chuck Hill, P.O. Box 1607, Bellevue, WA 98009

2. Accompanied by: None Exam Date: 4/12/04, 10/26/04, 11/17/04

Address: _____ Phone No.: _____

Relationship to Permit Holder: _____

3. Source: Groundwater tributary to _____

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. Point(s) of Diversion:

Ident No	Gov't Lot	¼	¼	¼	Sec.	Twp.	Rge.	County	Method of Determination / Remarks
		NW	NE	NE	23	1S	17E	Blaine	GIS

2. Place(s) of Use: _____ Indicate Method of Determination: GIS

TWP	RNG	SEC	NE				NW				SW				SE				TOTALS
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
1S	17E	23		J															
1S	17E	23		G															

J = Aesthetic, G = Heating

3. **Delivery System Diagram:** Indicate all major components and distances between components. Indicate weir size/ ditch size/ pipe i.d. as applicable.

See Attached Grid sheet

- ☒ Copy of USGS Quadrangle attached showing location(s) of point(s) of diversion and place(s) of use (*required*).
- ☒ Aerial photo attached (*required for irrigation of 10+ acres*).
- ☒ 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
Artesian well	n/a	n/a	n/a	n/a	n/a

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calibration
2" 45 degree trapezoidal flume		Plasti-Fab				

2. Measurements: H = 0.43 feet (slant distance), corresponds to 0.22 cfs / 99 gpm.
- Estimate 10 gpm leakage through berm. Total discharge = 0.24 cfs / 109 gpm.
-
-

E. NARRATIVE / REMARKS / COMMENTS

See attached narrative.

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

F. FLOW CALCULATIONS

☐ Additional Computation Sheets Attached

Measured Method: 0.24 cfs (see above).

G. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation:

$V_{I.R.} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) =$ _____

$V_{D.R.} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation Season}) \times 1.9835 =$ _____

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

2. Volume Calculations for Other Uses:

Aesthetic: 0.15 cfs x 365 days/year x 1.9835 = 108.6 acre-feet

Heating: 0.09 cfs x 365 days/year x 1.9835 = 65.2 acre-feet

H. RECOMMENDATIONS

1. Recommended Amounts

Beneficial Use	Period of Use		Rate of Diversion Q (cfs)	Annual Volume V (afa)
	From	To		
<u>Aesthetic</u>	<u>1/1</u>	<u>12/31</u>	<u>0.15</u>	<u>108.6</u>
<u>Heating</u>	<u>1/1</u>	<u>12/31</u>	<u>0.09</u>	<u>65.2</u>
_____	_____	_____	_____	_____
TOTALS:			<u>0.24</u>	<u>173.8</u>

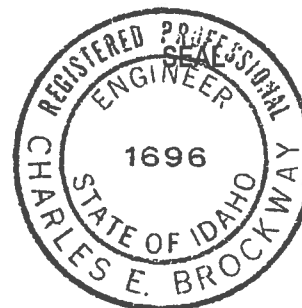
2. Recommended Amendments

- ☐ 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: Charles E. Brockway Date: 1/12/05

Reviewer: _____ Date: _____



Narrative for Beneficial Use Field Report
Permit No. 37-8365
South Cove Ventures, LLC

Prepared by Brockway Engineering, PLLC
C. G. Brockway, P.E.
C. E. Brockway, P.E.
January 10, 2005

Overview

This permit pertains to a geothermal artesian well located in NW1/4 NE1/4 NE1/4 of Section 23, T. 1S, R. 17 E. The well is situated just north of the Hot Springs Landing parking lot and boat ramp.

The artesian well was drilled in 1965 in response to a cessation of flow at nearby hot springs. A well drilling record is included with this report. The springs apparently ceased to flow due to blasting on the nearby county roadway, based on a review of the water right file and information provided by the previous owner. The well is 8 inches in diameter with a completed depth of 260 feet. The well is cased with 8-inch steel casing from 0 to 41 feet and the remainder is open hole through clay and basalt layers. At the time of drilling, the well was flowing and the water temperature was reported as 150 °F.

The artesian well head consists of two 4-foot sections of 36" CMP culverts with a slotted cap placed on top. Various pipes with control valves have been fitted to the CMP sections, and numerous small holes have been drilled in the sides of the culverts to allow water to escape. See attached photos. Apart from the small holes, only one of the pipes was discharging water at the time of the site inspection. The water level in the culvert could not be directly measured, but it was approximately as noted on the attached photo since no water was exiting holes or slots above this height. This indicates that the artesian pressure of the well at the measured discharge is low (4 feet or less). At lower flows, the artesian pressure will rise and it is apparent that water has risen to the top of the culvert sections as evidenced by mineral deposition around the upper outlets and the slots in the cap. The shutoff head is not known and cannot be measured with the well in its current configuration.

The Proof of Beneficial Use was filed on January 16, 1997 before the deadline of February 1, 1997, which was an extended deadline per an extension of time granted on December 5, 1995.

Due to repeated vandalism over approximately the past 10 years, beneficial use of the geothermal water has declined and the water is presently not being utilized. The purpose of this beneficial use examination, however, is to ascertain the nature of beneficial use and determine the quantity of such use as of the date of the Proof filing. Any decline or cessation of usage since that date should not be adverse to the permittee since a permit is not subject to forfeiture based on IDWR policy.

Evidence of beneficial use

Substantial evidence of beneficial use still exists on the site, although all facilities are in poor condition. The best attempt was made to reconstruct the system as accurately as possible and determine the maximum extent of beneficial use, based on 1) field evidence existing currently, 2) aerial photo evidence, 3) review of the water rights file, and 4) discussions with the previous owner, Norman Fuller. The attached diagram represents a reconstruction of the system showing all system components.

On-ground evidence includes the following:

- Wellhead developed and artesian flow captured, numerous pipelines exiting the wellhead casing. Well currently discharges to a 120'x12' pool, and overflow from the pool falls down embankment, disperses on a bluff, and returns to Magic Reservoir.
- Greenhouse frame and piping near the wellhead. The 3-inch galvanized pipe discharging water from the well apparently fed the greenhouse and appears to have been connected to the 4-inch aluminum line that begins there. The greenhouse consists of a steel frame, mesh walls, and steel-framed platforms within the structure. Also in the greenhouse is a 4'x8'x3' concrete tank that has clearly contained geothermal water based on watermark evidence.
- 4" aluminum pipeline in place from the greenhouse to the pool/bath facility. This pipeline is in good condition and runs from the greenhouse approximately 400 feet to a concrete pool. The pipe lies on the ground surface along its entire length.
- 15'x30'x3' concrete pool. This pool is fed by the 4" aluminum line and has clearly contained geothermal water based on watermarks. The inlet pipe is visible and numerous 2" steel pipes are on the ground next to the pool. The pool was apparently used as a bathing facility. No evidence of a covering was found – it is assumed that the pool was an outdoor facility.
- 20'x30' cabin. The cabin is located immediately west of the concrete pool. A 2" steel pipe diverts from the 4" aluminum line upstream of the pool, enters the house, makes a U-turn, and exits the house. No facilities currently exist in the cabin, but plumbing is in place for a sink, shower, and toilet. This cabin was apparently heated with the geothermal water. The cabin was wood framed and had minimal insulation in the walls or attic at the time of the inspection.
- Small bathing pool. This is a 5.5-foot diameter galvanized stock tank located west of the cabin. Both a 1-inch poly pipe and 2-inch plastic pipe appear to have fed this tank. The inlet of these pipes is at the end of the ditch along the road, at the point where water in the ditch would fall over the bluff. The tank is located off the bluff about 25 feet vertically below the elevation of the cabin and ditch.

- Concrete tanks. Three (3) 4'x8'x3' concrete tanks were present south of the well near the boat ramp. Only one tank appears to have contained geothermal water based on watermark evidence; this tank also has 2" pipes fitted to the concrete walls as inlets and outlets. Near these tanks are numerous pieces of 1" steel pipe.

Coverage of aerial photos in this area is relatively limited. The only available photo from the 1990s is a 1995 photo from the Farm Service Agency. Although the FSA conducts flights every year, this area was not covered in other years. The FSA photo is a medium-altitude flight, but provides a clear indication that several structures were present in 1995 that are not present today. Mr. Fuller confirmed that three additional cabins were present at that time. Also, a fish pond had been developed below the bluff; evidence of a small dike to create this pond exists today. The estimated size of the pond is about 30'x30'.

Discharge and temperature measurement

A measurement of the discharge from the well was made by placing a portable 2-inch trapezoidal flume in the channel approximately 50 feet downstream of the well. All water flowing from the pool over the embankment was captured at the flume location, so the flume reading should represent nearly the total well discharge. A small amount (estimated 10 gpm) of water was seeping through the embankment, emerging at the toe of the embankment some distance downstream from the flume location. Using the flume setup, the measured discharge was 99 gpm (0.22 cfs); accounting for leakage, the estimated total discharge of the well was 109 gpm.

Temperature readings were taken at four locations. Recorded temperatures were as follows:

Well head inside culvert	167°F
Water discharging from pipe	167 °F
Pool near well head	146 °F
Measuring flume	143 °F

These data indicate the anticipated result that, because of the high temperature gradient between the discharge water and the ambient air temperature, the water cools at least 20 °F within a few minutes if exposed to the air.

Heat transfer and flow requirement calculations

Typical utilization of geothermal water involves a "cascade" of uses in series, each use extracting heat from the water until the heat content is exhausted. This appears to be the methodology employed in this case. An evaluation was made of heat requirements for each of the identified uses, with the piping/distribution system configuration reconstructed as accurately as possible. For space heating flow requirements, standard procedures developed by IDWR were utilized. To calculate heat losses from open water

and pipelines, spreadsheet tools developed by the Oregon Institute of Technology Geo-Heat Center were used.

A schematic of the system is shown on the attached diagram. Each component is labeled for reference to the applicable heat loss and/or flow calculation. There are three flow paths corresponding to three outlets from the wellhead. Each path involves a series of heat loss elements and one or more end-use heat demands.

For open water (ponds, ditches), heat loss was calculated as a function of wind velocity, ambient air temperature, and relative humidity. The GeoHeat Center tool calculates a flow requirement given an upstream water temperature and a desired downstream water temperature. Upstream temperature is generally based on the output from the next upstream element. Downstream temperature for the bathing pools was set equal to 85 degrees F, a comfortable level for bathing. Downstream temperature for the fish pond was set equal to 80 degrees F, an average level for raising warm-water species such as catfish.

Space heating requirement for the cabins and greenhouses was calculated using the IDWR spreadsheet developed by Cindy Hodges. Inside design temperature was assumed to be 72 degrees F, and the average outside temperature was assumed to be -6 degrees F. This represents a maximum demand condition for this geographic location. The "efficiency factor" was set equal to 1.11, representing minimal insulation and generally poor energy efficiency, indicative of the type of construction in the existing cabin. The spreadsheet calculates a flow rate requirements given the above inputs and a source water temperature. Source temperature is generally based on the output from the next upstream element.

Heat losses in pipelines connecting the system components was calculated using the GeoHeat Center tool for exposed bare plastic pipe. Ambient air temperature was assumed to be -6 degrees F. Given an inlet temperature, the spreadsheet calculates a temperature drop, and hence an outlet temperature.

The solution to the flow rate requirement for the entire facility is iterative, since the required flow rate for a given use depends on the water temperature, but the water temperature in turn depends on the flow rate and heat losses in the upstream components. A solution is converged upon within a few manual trials.

The attached spreadsheets represent each numbered component in the system schematic. The calculations indicate that the total flow rate requirement for all uses is 126 gpm (0.28 cfs).

Check on system hydraulic capacity

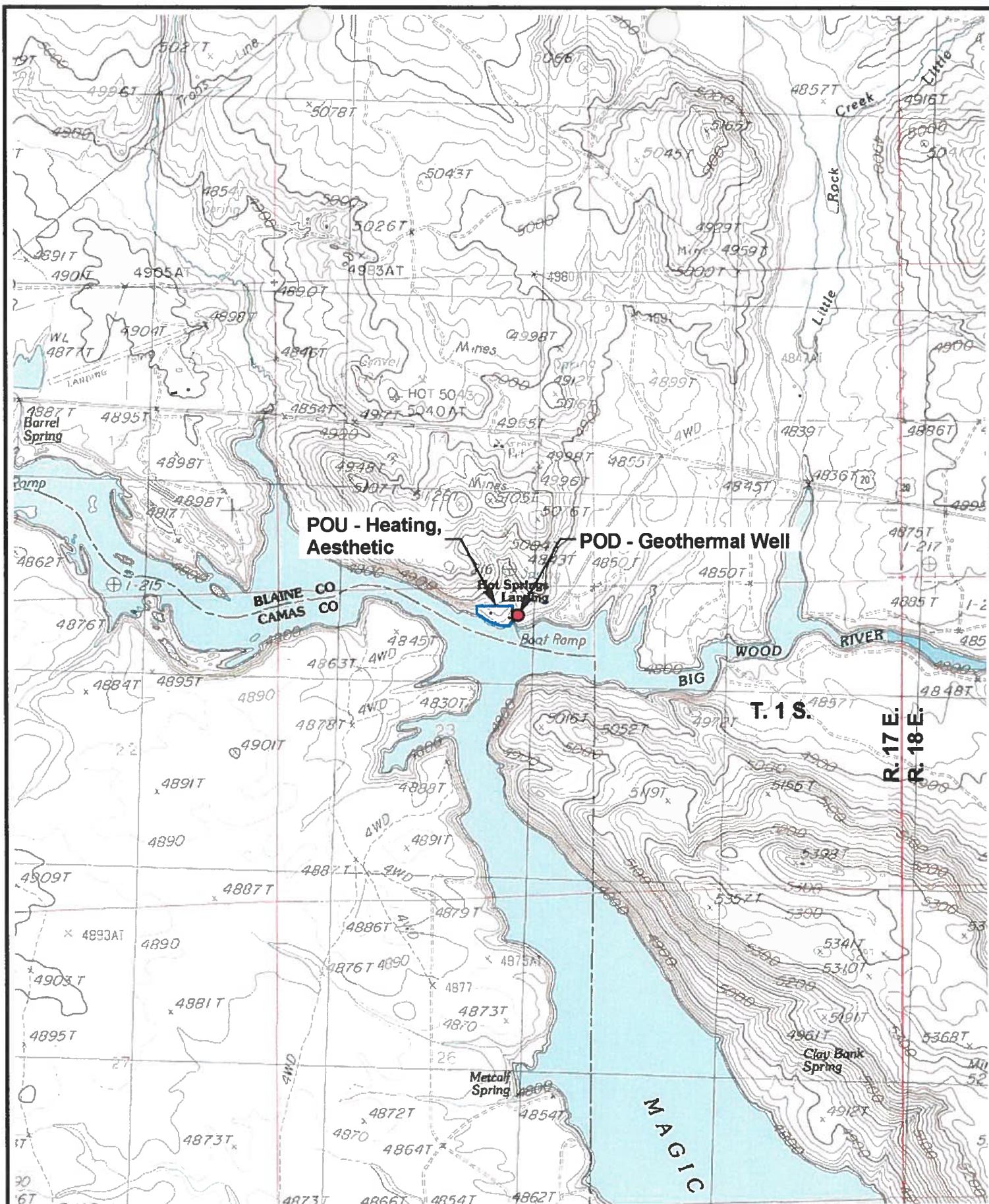
A hydraulic calculation was made to check the capacity of the 3" and 4" pipelines leading to the greenhouse, bathing pool, and cabin. It was found that with an estimated elevation drop of 5 feet from the well to the pool and 3 feet of head in the well casing, 161 gpm can be carried by the pipeline (see attached calculations). Therefore, hydraulic capacity in this pipe will not be limiting. The 2-inch supply pipe (element 9) is also not

hydraulically limiting – the head drop from the end of the ditch (element 8) to element 10 is at least 30 feet and this pipe can easily carry the calculated 27 gpm. The ditch has a bottom width of approximately 12 inches and a depth of approximately 1.5 feet, and can easily carry 27 gpm. To serve the three north cabins (element 14), a pump would have been needed to deliver the calculated 12 gpm.

Recommended amounts

The measured discharge from the well was 109 gpm (0.24 cfs). The calculated maximum flow rate requirement for beneficial uses and system heat losses is 126 gpm (0.28 cfs). The permit was approved for 0.14 cfs for commercial, 0.27 cfs for heating, and 0.14 cfs for aesthetic, with a total of 0.41 cfs. The limiting value is the measured discharge from the well.

It is recommended that the total discharge be limited to 0.24 cfs. Aesthetic use should be 0.15 cfs (67 gpm), the required flow rate in the fish ponds (element 12). Since it appears that no commercial activity was conducted at the facility, the remainder of the flow rate (0.09 cfs or 40 gpm) should be listed for heating purposes.



BENEFICIAL USE EXAMINATION - VICINITY MAP

PERMIT 37-8365 / SOUTH COVE VENTURES

Brockway Engineering
January 12, 2005

T.01S. R. 17E SEC. 23 NWNE

DESTROYED CABIN

DESTROYED CABIN

DESTROYED CABIN

2" PIPE

SMALL POOL

DITCH

WELL

POOL

GREENHOUSE

4" PIPE

HOT SPRINGS LANDING
PARKING LOT

CABIN AND POOL

2" PIPE

DIKE

FORMER FISH
POND

CONCRETE POOLS

APPROXIMATE HIGH
WATER LINE OF
MAGIC RESERVOIR



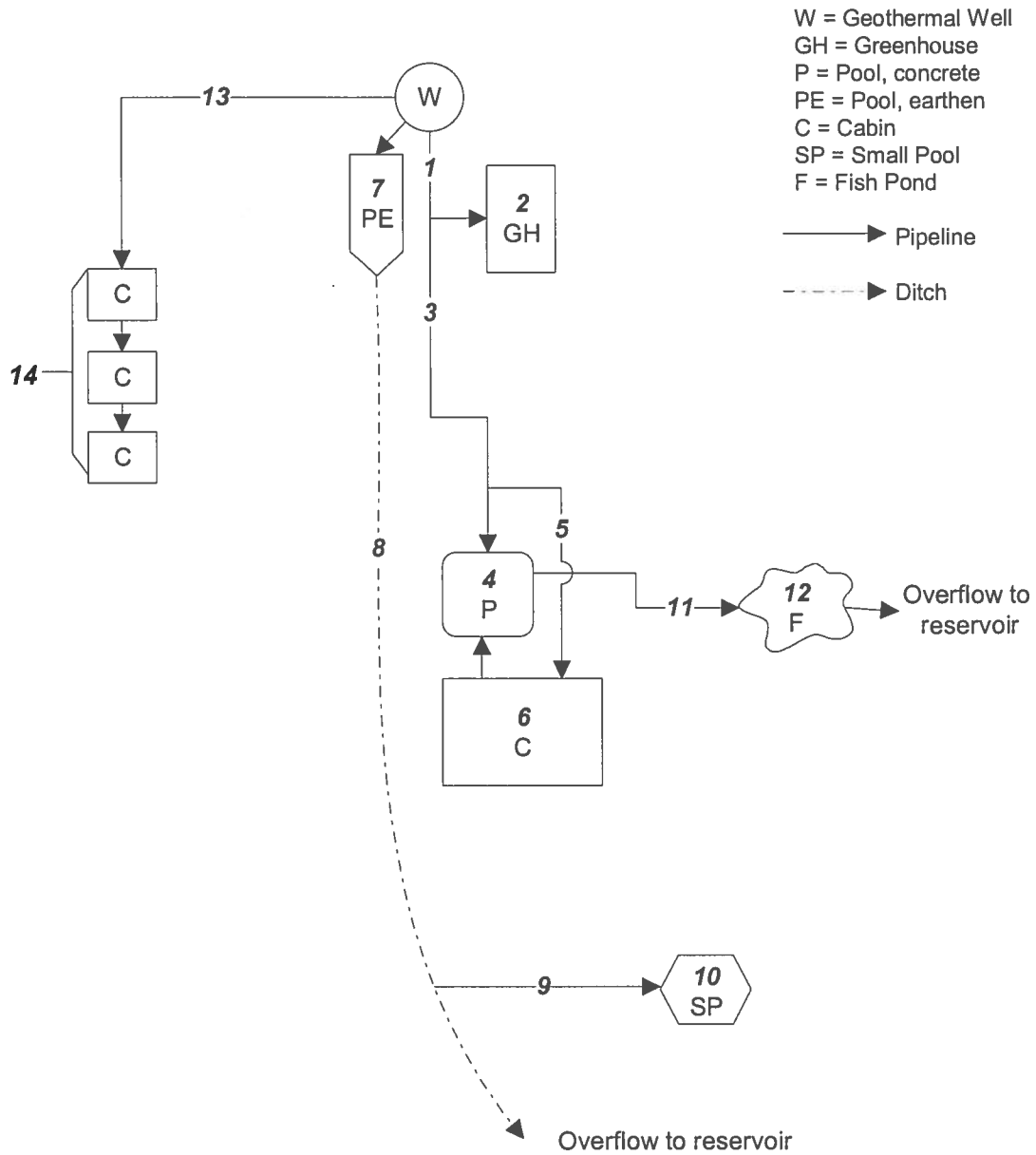
SOUTH COVE VENTURES
BENEFICIAL USE EXAM FOR 37-8365
NAIP 2003 AERIAL PHOTO

BROCKWAY ENGINEERING, PLLC.
ALR JAN. 4, 2005

Chart1

Tuesday, January 04, 2005

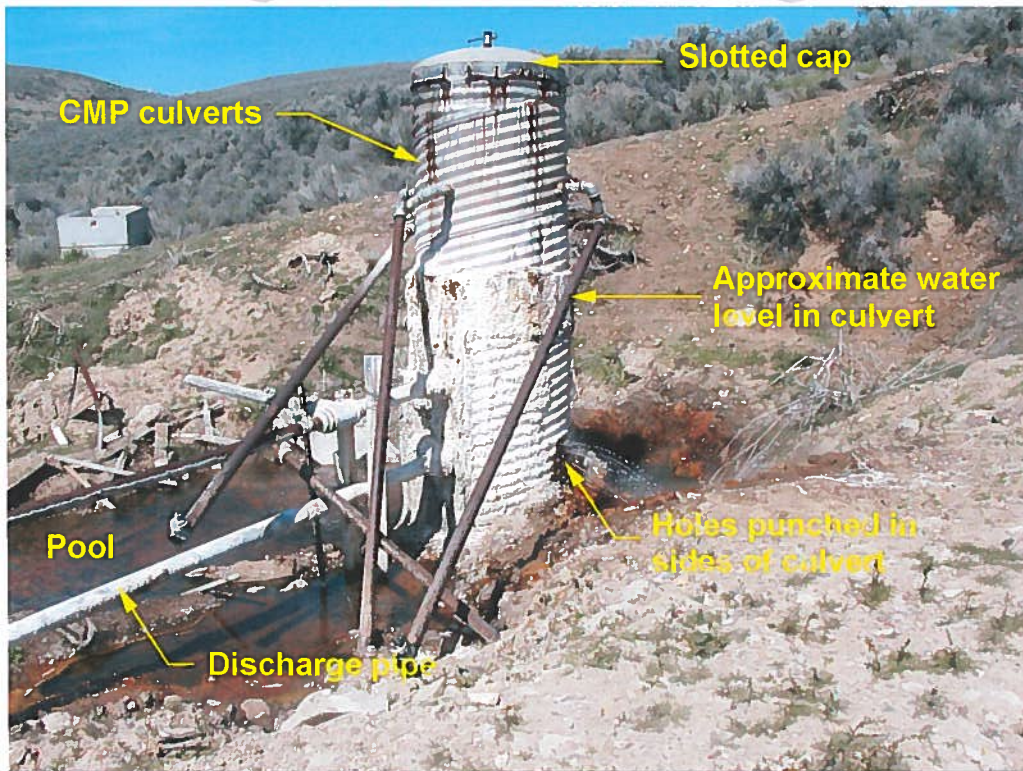
10:45 AM



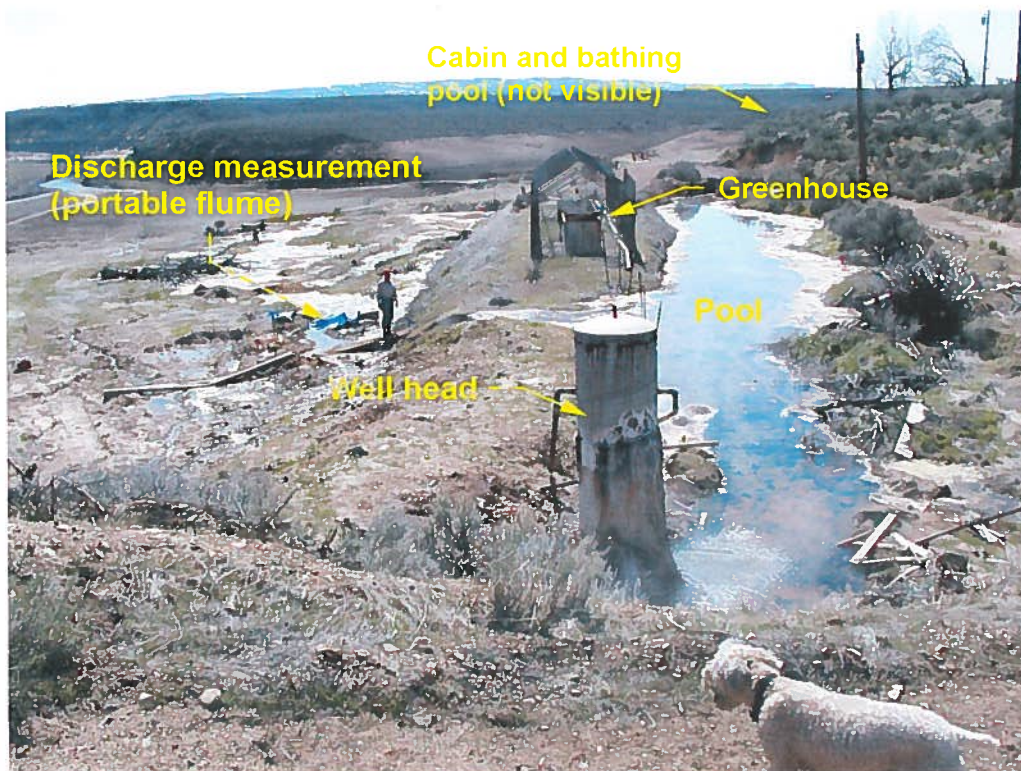
SCHEMATIC DIAGRAM OF RECONSTRUCTED GEOTHERMAL USAGE

South Cove Partners
Beneficial Use Examination
37-8365

Brockway Engineering
January 4, 2005



Well Head and Collection System

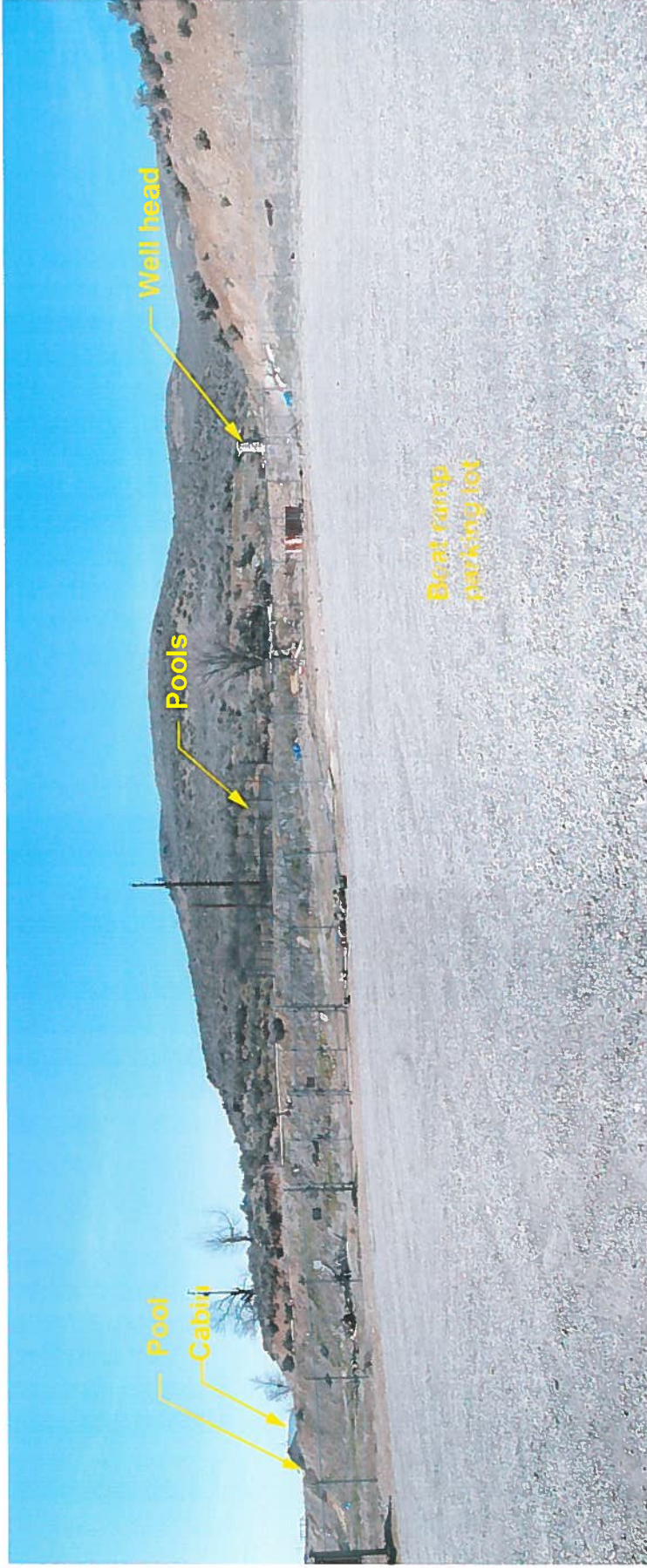


Well Head and Vicinity Looking West

BENEFICIAL USE EXAMINATION PHOTOS

PERMIT 37-8365 / SOUTH COVE VENTURES

Brockway Engineering
December 29, 2004



Panoramic View Looking Northwest from Parking Lot

BENEFICIAL USE EXAMINATION PHOTOS
PERMIT 37-8365 / SOUTH COVE VENTURES



Fish Pond former location



Concrete Pools

BENEFICIAL USE EXAMINATION PHOTOS

PERMIT 37-8365 / SOUTH COVE VENTURES

Brockway Engineering
December 29, 2004



Existing Cabin and Pool



View Inside Cabin

BENEFICIAL USE EXAMINATION PHOTOS
PERMIT 37-8365 / SOUTH COVE VENTURES

Brockway Engineering
December 29, 2004



Small Pool



Ditch

BENEFICIAL USE EXAMINATION PHOTOS

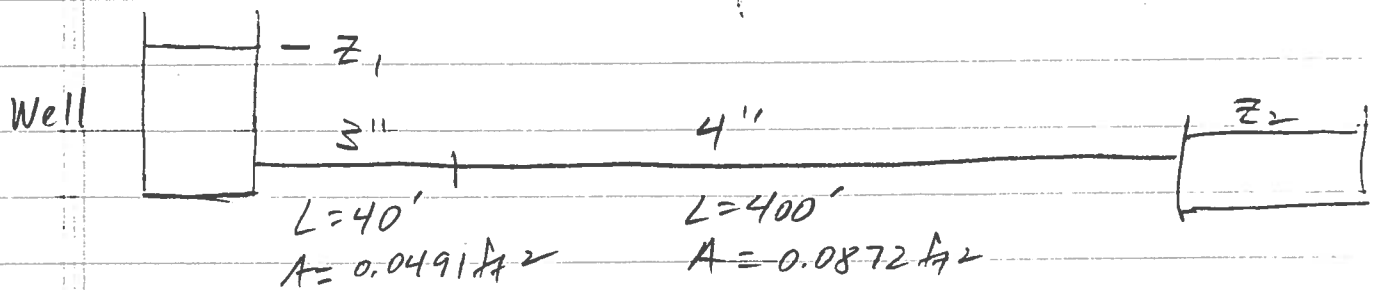
PERMIT 37-8365 / SOUTH COVE VENTURES

Brockway Engineering
December 29, 2004

37-8365

1/10/05 CLE

Check hydraulic capacity of 3"/4" pipe:



Entrance: $C_L = 0.5$

Expansion: $C_L = \left[1 - \left(\frac{3}{4}\right)^2\right]^2 = 0.19$

Exit: $C_L = 1.0$

$f = 0.016$

$Z_1 - Z_2 = 3 \text{ ft (at well)} + 5 \text{ ft (fric. drop)} = 8 \text{ ft.}$

Darcy-Weisbach:

$$h_L = \left(\sum C_L + \frac{fL}{D} \right) \frac{Q^2}{2gA^2}$$

$$= \left[0.5 + \frac{0.016(40)}{0.25} + 0.19 \right] \frac{Q^2}{2g(0.0491)^2}$$

$$+ \left[\frac{0.016(400)}{0.333} + 1.0 \right] \frac{Q^2}{2g(0.0872)^2}$$

$$= 20.95 Q^2 + 41.29 Q^2$$

$$h_L = 62.24 Q^2$$

$$h_L = 8.0 \text{ ft} \Rightarrow Q = 0.359 \text{ cfs}$$

$$= \underline{\underline{161 \text{ gpm}}}$$

FAIRFIELD 3 SE, IDAHO

Monthly Average Minimum Temperature (Degrees Fahrenheit)

(103110)

File last updated on Dec 15, 2004

*** Note *** Provisional Data *** After Year/Month 199803

a = 1 day missing, b = 2 days missing, c = 3 days, ..etc.,

z = 26 or more days missing, A = Accumulations present

Long-term means based on columns; thus, the monthly row may not sum (or average) to the long-term annual value.

MAXIMUM ALLOWABLE NUMBER OF MISSING DAYS : 5

Individual Months not used for annual or monthly statistics if more than 5 days are missing.

Individual Years not used for annual statistics if any month in that year has more than 5 days missing.

YEAR (S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1978	6.52	5.68	15.65	29.53	31.61	37.07	43.97	38.94	35.23	21.74	15.43	3.71	23.76
1979	-6.58	7.25	15.29	25.83	33.90	37.10	44.19	43.35	33.30	27.68	8.50 d	4.71	22.88
1980	2.55	9.17	14.71	30.27	35.77	37.27	42.42	38.61	36.48 a	22.48	16.20	4.68	24.22
1981	5.32	2.96	20.10	28.97	34.94	38.50	41.03	44.71 c	32.93 b	22.97 a	19.76 a	10.87 a	25.25
1982	-1.10	-----z	-----z	-----z	33.68	40.27	45.26	42.90	34.93	23.06	9.90	2.39	25.70
1983	9.35	-----z	21.74	25.43	36.35	40.50	43.26	48.61	32.37	27.42	19.40	-0.35	27.64
1984	-7.74	-10.00 u	12.35	25.43	35.87	40.07	49.19	45.52	32.37	21.68	18.20	-8.06	24.08
1985	-8.03 a	-12.46	3.67 j	28.07	35.58	39.57	48.55	39.39	33.60	23.97	10.17	-7.42	21.00
1986	2.10	6.36 n	24.26	30.47	33.42	42.93	42.26	44.16	32.73	23.81	18.50	5.94	27.32
1987	-2.48	4.68	22.55	-----z	37.71	40.37	43.61	39.10	32.43	21.23	20.33	11.94	24.68
1988	-0.52	9.03	22.35	28.47	33.23	43.30	45.65	39.77	31.10	27.87	14.00	-2.97	24.27
1989	-7.68	-4.54	17.26	28.60	34.03	39.47	45.00	39.61	31.97	28.29	15.73	6.61	22.86
1990	11.71	-1.61	18.90	31.23	30.71	37.80	44.71	43.45	37.50	22.42	16.67	-6.81	23.89
1991	-5.42	18.29	22.00	26.20	33.26	36.73	45.32	45.61	37.83	25.71	18.50	3.81	25.65
1992	4.65	20.69	24.58	27.80	35.90	44.40	43.84	43.19	31.67	27.81	16.73	-0.06	26.77
1993	-3.94	0.82	17.77	28.27	40.13	38.67	37.90	39.26	29.90	25.81	4.43	2.32	21.78
1994	7.03	2.18	17.74	28.77	37.00	37.23	44.74	42.84	34.17	25.06	8.10	1.65	23.88
1995	6.84	9.82	16.97	28.23	35.32	40.47	44.55	38.61	33.23	20.77	22.30	8.16	25.44
1996	8.77	3.50 a	18.55	29.33	34.71	40.20	44.77	40.52	30.83	23.68	18.28 l	23.00 t	27.49
1997	4.58	3.64	14.94	27.00	35.42	43.07	44.77	44.16	40.84 e	27.29 c	18.38 a	9.38 g	27.64
1998	14.82 c	12.54 d	14.48 b	27.67 i	35.38 o	39.45 h	47.24 n	47.27 t	-----z	-----z	-----z	-----z	13.95

Period of Record Statistics

MEAN	1.94	5.39	18.54	28.22	34.93	39.75	44.25	42.12	33.77	24.54	15.33	2.28	24.22
S.D.	6.86	7.96	3.58	1.70	2.11	2.29	2.39	2.91	2.69	2.52	4.87	5.81	1.39
SKEW	0.01	-0.11	0.17	-0.18	0.28	0.49	-0.39	0.39	1.02	0.15	-0.76	-0.32	0.09
MAX	14.82	20.69	24.58	31.23	40.13	44.40	49.19	48.61	40.84	28.29	22.30	11.94	26.77
MIN	-8.03	-12.46	12.35	25.43	30.71	36.73	37.90	38.61	29.90	20.77	4.43	-8.06	21.78
NO YRS	21	17	19	18	20	20	20	20	20	20	19	18	12



$$90\% \text{ min} = 24.54 - 1.28 (2.69) = 21.1^{\circ}\text{F}$$

(1 - Z₉₀ σ)

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 1: 3" PIPE WELL TO GREENHOUSE

HEAT LOSS - BARE PLASTIC PIPE TO AIR

INPUT

1. TUBE OD (inches)	3	inches	
2. AIR TEMPERATURE (F)	-6	F	
3. ENT. WATER TEMP (F)	165.0	F	
4. WATER FLOW (gpm)	87.0	gpm	16.4
5. EMISIVITY (decimal)	0.9		
6. HORIZ (1.016) VERT (1.235)	1.016		
7. TUBE LENGTH (ft)	50	ft	

OUTPUT

1. TOTAL UNIT OUTPUT	246.9	btu/hr lf
2. CONVECTIVE UNIT OUTPUT	125.7	btu/hr lf
3. RADIANT UNIT OUTPUT	121.2	btu/hr lf
4. TOTAL OUTPUT	12347.2	btu/hr
5. DELTA T	0.3	F
6. OUTLET TEMPERATURE	164.7	F

	Run 1	Run 2	Run 3	Run 4	Run 5	
sqft/lf	0.79	164.86	164.86	164.86	164.86	new AWT
surf temp	153.03	152.90	152.90	152.90	152.90	new surf t
unit conv	160.0	160.1	160.1	160.1	160.1	
unit rad	154.6	154.4	154.4	154.4	154.4	
btu/hr lf	247.0	246.9	246.9	246.9	246.9	
btu/hr	12348	12347	12347	12347	12347	
delta t	0.3	0.3	0.3	0.3	0.3	

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT COMPONENT 2: GREENHOUSE

RESIDENTIAL SPACE HEATING/COOLING REQUIREMENTS FOR COLD OR GEOTHERMAL SOURCES

Worksheet created by Cindy Hodges, 11/93.

Data entered by: C.E. Brockway Hot Spring Landing-Greenhouse
Exam Date: April 26,2001 Green house 500 sq ft
File No: 494-01-2001 sq ft
Computations for: Heating sq ft

REQUIRED DATA: Total 500 sq ft

Area of livable floor space, ft2 (A) 500
2 story? (N=1, Y=2) 1
House efficiency factor (e) * Greenhouse est. 1.11
Inside design temperature (Ti) 70
Average outside temperature (To) ** -6
Source temperature, degrees F (S) 164.7
Heating/cooling days per season (D) 250
Hours/day system operates (H) 24

CALCULATED DATA:

DESIGN HEAT LOAD (BTU/hr required)
Formula: $E = [e \times (Ti - To)] \times A$
Applies factor of 0.8 for two-story dwelling

E = 42,180 BTU/hour

TEMPERATURE DROP ACROSS SYSTEM
Formula: $Ts = 0.3 \times [S - Ti]$

Ts = 28.4148466 degrees F

FLOW RATE REQUIRED (at given source temperature)
Formula: $Q = E / (500 \times Ts) \times 448.8$

Q = 0.01 cfs
3.0 gpm

DIVERTED VOLUME OVER SEASON
Formula: $Vdiv = Q \times D \times H / 24 \times 1.9835$

Vdiv = 3.3 AFA

* e values are as follows:

- 0.28 Best energy efficiency - extra insulation, caulked and weatherstripped, with storm windows and doors
- 0.44 Better energy efficiency - standard insulation, caulked and weatherstripped, with storm windows and/or doors
- 0.67 Average residence - standard insulation, no weatherproofing but with storm windows or double panes
- 1.11 Poor energy efficiency - minimal insulation, no weatherproofing or storm windows (older homes, shops or greenhouses)

** Suggested average outside temperatures:

WINTER
4 deg F Boise
6 deg F Grand View
-8 deg F Cascade
SUMMER
80 deg F Boise
90 deg F Grand View
70 deg F Cascade

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 3: 4" PIPE GREENHOUSE TO POOL

HEAT LOSS - BARE PLASTIC PIPE TO AIR

INPUT

1. TUBE OD (inches)	4	inches
2. AIR TEMPERATURE (F)	-6	F
3. ENT. WATER TEMP (F)	164.7	F
4. WATER FLOW (gpm)	84.0	gpm
5. EMISIVITY (decimal)	0.9	
6. HORIZ (1.016) VERT (1.235)	1.016	
7. TUBE LENGTH (ft)	400	ft

OUTPUT

1. TOTAL UNIT OUTPUT	315.7	btu/hr lf
2. CONVECTIVE UNIT OUTPUT	156.3	btu/hr lf
3. RADIANT UNIT OUTPUT	159.4	btu/hr lf
4. TOTAL OUTPUT	126281.2	btu/hr
5. DELTA T	3.0	F
6. OUTLET TEMPERATURE	161.7	F

	Run 1	Run 2	Run 3	Run 4	Run 5	
sqft/lf	1.05	163.20	163.21	163.21	163.21	new AWT
surf temp	152.77	151.35	151.37	151.37	151.37	new surf t
unit conv	150.7	149.4	149.4	149.4	149.4	
unit rad	154.3	152.2	152.2	152.2	152.2	
btu/hr lf	319.2	315.7	315.7	315.7	315.7	
btu/hr	127683	126264	126281	126281	126281	
delta t	3.0	3.0	3.0	3.0	3.0	

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 4: BATHING POOL

HEAT LOSS FROM PONDS

1. Resource temp	161.7 F	
2. Length	15 ft	
3. Width	30 ft	
4. Water temp downstream	85 F	
5. Wind velocity	10 mph	
6. Air temp	-6 F	
7. Cover thickness	0 in	
8. Cover "k"	0.4 btu in/hr sqft F	
9. Relative humidity	20 %	
10. Calculated water vap pres	0.589 psia	
1. Evaporative Loss	113365 btu/hr	251.9 btu/hr sqft
2. Convective Loss	103261 btu/hr	229.5 btu/hr sqft
3. Radiant Loss	33307 btu/hr	74.0 btu/hr sqft
4. Conductive Loss	7524 btu/hr	16.7 btu/hr sqft
5. Total Loss	257457 btu/hr	572.1 btu/hr sqft
6. Required flow rate	6.7 gpm	

ha	2.521633
x/k	0
p. press	0.005
area	450
surf temp	85
U	2.521633

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 5: 2" PIPE POOL TO CABIN

HEAT LOSS - BARE PLASTIC PIPE TO AIR

INPUT

1. TUBE OD (inches)	2 inches
2. AIR TEMPERATURE (F)	-6 F
3. ENT. WATER TEMP (F)	161.7 F
4. WATER FLOW (gpm)	77.32 gpm
5. EMISIVITY (decimal)	0.9
6. HORIZ (1.016) VERT (1.235)	1.016
7. TUBE LENGTH (ft)	40 ft

OUTPUT

1. TOTAL UNIT OUTPUT	167.3	btu/hr lf
2. CONVECTIVE UNIT OUTPUT	88.8	btu/hr lf
3. RADIANT UNIT OUTPUT	78.6	btu/hr lf
4. TOTAL OUTPUT	6693.1	btu/hr
5. DELTA T	0.2	F
6. OUTLET TEMPERATURE	161.5	F

	Run 1	Run 2	Run 3	Run 4	Run 5	
sqft/lf	0.52	161.62	161.62	161.62	161.62	new AWT
surf temp	149.97	149.89	149.89	149.89	149.89	new surf t
unit conv	169.4	169.6	169.6	169.6	169.6	
unit rad	150.3	150.1	150.1	150.1	150.1	
btu/hr lf	167.3	167.3	167.3	167.3	167.3	
btu/hr	6691	6693	6693	6693	6693	
delta t	0.2	0.2	0.2	0.2	0.2	

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 6: CABIN

RESIDENTIAL SPACE HEATING/COOLING REQUIREMENTS FOR COLD OR GEOTHERMAL SOURCES

Worksheet created by Cindy Hodges, 11/93.

Data entered by: C.E. Brockway Hot Spring Landing-Greenhouse
Exam Date: 10/28/04 600 sq ft
File No: sq ft
Computations for: Heating sq ft
sq ft
sq ft
sq ft

REQUIRED DATA:	Total
Area of livable floor space, ft2 (A)	600
2 story? (N=1, Y=2)	1
House efficiency factor (e) * Greenhouse est.	1.11
Inside design temperature (Ti)	72
Average outside temperature (To) **	-6
Source temperature, degrees F (S)	161.5
Heating/cooling days per season (D)	250
Hours/day system operates (H)	24

CALCULATED DATA:

DESIGN HEAT LOAD (BTU/hr required)
Formula: $E = [e \times (Ti - To)] A$
Applies factor of 0.8 for two-story dwelling

E = 51,948 BTU/hour

TEMPERATURE DROP ACROSS SYSTEM
Formula: $Ts = 0.3 \times [S - Ti]$

Ts = 26.861233 degrees F

FLOW RATE REQUIRED (at given source temperature)
Formula: $Q = E / (500 \times Ts) \times 448.8$

Q = 0.01 cfs
3.87 gpm

DIVERTED VOLUME OVER SEASON
Formula: $Vdiv = Q \times D \times H / 24 \times 1.9835$

Vdiv = 4.3 AFA

* e values are as follows:
0.28 Best energy efficiency - extra insulation, caulked and weatherstripped, with storm windows and doors
0.44 Better energy efficiency - standard insulation, caulked and weatherstripped, with storm windows and/or doors
0.67 Average residence - standard insulation, no weatherproofing but with storm windows or double panes
1.11 Poor energy efficiency - minimal insulation, no weatherproofing or storm windows (older homes, shops or greenhouses)
** Suggested average outside temperatures:
WINTER
4 deg F Boise
6 deg F Grand View
-8 deg F Cascade
SUMMER
80 deg F Boise
90 deg F Grand View
70 deg F Cascade

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 7: EARTHEN POND

HEAT LOSS FROM PONDS

1. Resource temp	165.0 F	
2. Length	8 ft	
3. Width	120 ft	
4. Water temp downstream	109.98 F	
5. Wind velocity	10 mph	
6. Air temp	-6 F	
7. Cover thickness	0 in	
8. Cover "k"	0.4 btu in/hr sqft F	
9. Relative humidity	20 %	
10. Calculated water vap pres	1.379 psia	
1. Evaporative Loss	412687 btu/hr	429.9 btu/hr sqft
2. Convective Loss	212777 btu/hr	221.6 btu/hr sqft
3. Radiant Loss	97964 btu/hr	102.0 btu/hr sqft
4. Conductive Loss	27790 btu/hr	28.9 btu/hr sqft
5. Total Loss	751217 btu/hr	782.5 btu/hr sqft
6. Required flow rate	27.31 gpm	

ha	1.91104
x/k	0
p. press	0.005
area	960
surf temp	109.98
U	1.91104

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 8: OPEN DITCH

HEAT LOSS FROM PONDS

1. Resource temp	110.0 F	
2. Length	1.5 ft	
3. Width	450 ft	
4. Water temp downstream	86.65 F	
5. Wind velocity	10 mph	
6. Air temp	-6 F	
7. Cover thickness	0 in	
8. Cover "k"	0.4 btu in/hr sqft F	
9. Relative humidity	20 %	
10. Calculated water vap pres	0.623 psia	
1. Evaporative Loss	104394 btu/hr	154.7 btu/hr sqft
2. Convective Loss	91751 btu/hr	135.9 btu/hr sqft
3. Radiant Loss	51133 btu/hr	75.8 btu/hr sqft
4. Conductive Loss	71166 btu/hr	105.4 btu/hr sqft
5. Total Loss	318445 btu/hr	471.8 btu/hr sqft
6. Required flow rate	27.30 gpm	

ha	1.467113
x/k	0
p. press	0.005
area	675
surf temp	86.65
U	1.467113

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 9: 2" PIPE TO SMALL POOL

HEAT LOSS - BARE PLASTIC PIPE TO AIR

INPUT

1. TUBE OD (inches)	2 inches
2. AIR TEMPERATURE (F)	-6 F
3. ENT. WATER TEMP (F)	86.65 F
4. WATER FLOW (gpm)	27.3 gpm
5. EMISIVITY (decimal)	0.9
6. HORIZ (1.016) VERT (1.235)	1.016
7. TUBE LENGTH (ft)	75 ft

OUTPUT

1. TOTAL UNIT OUTPUT	77.1	btu/hr lf
2. CONVECTIVE UNIT OUTPUT	42.3	btu/hr lf
3. RADIANT UNIT OUTPUT	34.9	btu/hr lf
4. TOTAL OUTPUT	5786.1	btu/hr
5. DELTA T	0.4	F
6. OUTLET TEMPERATURE	86.23	F

	Run 1	Run 2	Run 3	Run 4	Run 5	
sqft/lf	0.52	86.44	86.44	86.44	86.44	new AWT
surf temp	80.16	79.97	79.97	79.97	79.97	new surf t
unit conv	81.0	80.8	80.8	80.8	80.8	
unit rad	66.8	66.6	66.6	66.6	66.6	
btu/hrlf	77.3	77.1	77.1	77.1	77.1	
btu/hr	5799	5786	5786	5786	5786	
delta t	0.4	0.4	0.4	0.4	0.4	

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 10: SMALL BATHING POOL

HEAT LOSS FROM PONDS

1. Resource temp	86.23 F	
2. Length	4.5 ft	
3. Width	4.5 ft	
4. Water temp downstream	85 F	
5. Wind velocity	10 mph	
6. Air temp	-6 F	
7. Cover thickness	0 in	
8. Cover "k"	0.4 btu in/hr sqft F	
9. Relative humidity	20 %	
10. Calculated water vap pres	0.589 psia	
1. Evaporative Loss	7455 btu/hr	368.2 btu/hr sqft
2. Convective Loss	6791 btu/hr	335.4 btu/hr sqft
3. Radiant Loss	1499 btu/hr	74.0 btu/hr sqft
4. Conductive Loss	1399 btu/hr	69.1 btu/hr sqft
5. Total Loss	17144 btu/hr	846.6 btu/hr sqft
6. Required flow rate	28.0 gpm	

ha	3.685221
x/k	0
p. press	0.005
area	20.25
surf temp	85
U	3.685221

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 11: 2" PIPE FROM POOL TO FISH POND

HEAT LOSS - BARE PLASTIC PIPE TO AIR

INPUT

1. TUBE OD (inches)	2 inches
2. AIR TEMPERATURE (F)	-6 F
3. ENT. WATER TEMP (F)	85 F
4. WATER FLOW (gpm)	84.0 gpm
5. EMISIVITY (decimal)	0.9
6. HORIZ (1.016) VERT (1.235)	1.016
7. TUBE LENGTH (ft)	100 ft

OUTPUT

1. TOTAL UNIT OUTPUT	75.5	btu/hr lf
2. CONVECTIVE UNIT OUTPUT	41.4	btu/hr lf
3. RADIANT UNIT OUTPUT	34.1	btu/hr lf
4. TOTAL OUTPUT	7554.5	btu/hr
5. DELTA T	0.2	F
6. OUTLET TEMPERATURE	84.82	F

	Run 1	Run 2	Run 3	Run 4	Run 5	
sqft/lf	0.52	84.91	84.91	84.91	84.91	new AWT
surf temp	78.63	78.55	78.55	78.55	78.55	new surf t
unit conv	79.2	79.2	79.2	79.2	79.2	
unit rad	65.3	65.2	65.2	65.2	65.2	
btu/hr lf	75.6	75.5	75.5	75.5	75.5	
btu/hr	7559	7554	7554	7554	7554	
delta t	0.2	0.2	0.2	0.2	0.2	

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 12: FISH POND

HEAT LOSS FROM PONDS

1. Resource temp	84.8 F	
2. Length	30 ft	
3. Width	30 ft	
4. Water temp downstream	75.00 F	
5. Wind velocity	10 mph	
6. Air temp	21.1 F -- October minimum at 90% level	
7. Cover thickness	0 in	
8. Cover "k"	0.4 btu in/hr sqft F	
9. Relative humidity	20 %	
10. Calculated water vap pres	0.419 psia	

1. Evaporative Loss	160477 btu/hr	178.3 btu/hr sqft
2. Convective Loss	122324 btu/hr	135.9 btu/hr sqft
3. Radiant Loss	41292 btu/hr	45.9 btu/hr sqft
4. Conductive Loss	5368 btu/hr	6.0 btu/hr sqft
5. Total Loss	329461 btu/hr	366.1 btu/hr sqft
6. Required flow rate	67.10 gpm	

ha	2.521633
x/k	0
p. press	0.013
area	900
surf temp	75
U	2.521633

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 13: 2" PIPE FROM WELLHEAD TO NORTH CABINS

HEAT LOSS - BARE PLASTIC PIPE TO AIR

INPUT

1. TUBE OD (inches)	2 inches
2. AIR TEMPERATURE (F)	-6 F
3. ENT. WATER TEMP (F)	165 F
4. WATER FLOW (gpm)	11.6 gpm
5. EMISIVITY (decimal)	0.9
6. HORIZ (1.016) VERT (1.235)	1.016
7. TUBE LENGTH (ft)	200 ft

OUTPUT

1. TOTAL UNIT OUTPUT	168.0	btu/hr lf
2. CONVECTIVE UNIT OUTPUT	89.1	btu/hr lf
3. RADIANT UNIT OUTPUT	78.9	btu/hr lf
4. TOTAL OUTPUT	33595.2	btu/hr
5. DELTA T	5.8	F
6. OUTLET TEMPERATURE	159.21	F

	Run 1	Run 2	Run 3	Run 4	Run 5	
sqft/lf	0.52	162.04	162.11	162.10	162.10	new AWT
surf temp	153.03	150.28	150.34	150.34	150.34	new surf t
unit conv	173.5	170.1	170.2	170.2	170.2	
unit rad	154.6	150.7	150.8	150.8	150.8	
btu/hr lf	171.7	167.9	168.0	168.0	168.0	
btu/hr	34344	33578	33596	33595	33595	
delta t	5.9	5.8	5.8	5.8	5.8	

HOT SPRINGS LANDING GEOTHERMAL REQUIREMENT
COMPONENT 14: THREE NORTH CABINS ON HILL

RESIDENTIAL SPACE HEATING/COOLING REQUIREMENTS FOR COLD OR GEOTHERMAL SOURCES

Worksheet created by Cindy Hodges, 11/93.

Data entered by: C.E. Brockway Hot Spring Landing-Greenhouse
Exam Date: 10/28/04 1,800 sq ft (assume three 600-sf cabins)

File No: sq ft

Computations for: Heating sq ft

REQUIRED DATA: Total 1800 sq ft

Area of livable floor space, ft2 (A) 1800
2 story? (N=1, Y=2) 1
House efficiency factor (e) * Greenhouse est. 1.11
Inside design temperature (Ti) 72
Average outside temperature (To) ** -6
Source temperature, degrees F (S) 161.5
Heating/cooling days per season (D) 250
Hours/day system operates (H) 24

CALCULATED DATA:

DESIGN HEAT LOAD (BTU/hr required)
Formula: $E = [e \times (Ti - To)] A$
Applies factor of 0.8 for two-story dwelling

E = 155,844 BTU/hour

TEMPERATURE DROP ACROSS SYSTEM
Formula: $Ts = 0.3 \times [S - Ti]$

Ts = 26.861233 degrees F

FLOW RATE REQUIRED (at given source temperature)
Formula: $Q = E / (500 \times Ts) \times 448.8$

Q = 0.03 cfs
11.60 gpm

DIVERTED VOLUME OVER SEASON
Formula: $Vdiv = Q \times D \times H / 24 \times 1.9835$

Vdiv = 12.8 AFA

* e values are as follows:
0.28 Best energy efficiency - extra insulation, caulked and weatherstripped, with storm windows and doors
0.44 Better energy efficiency - standard insulation, caulked and weatherstripped, with storm windows and/or doors
0.67 Average residence - standard insulation, no weatherproofing but with storm windows or double panes
1.11 Poor energy efficiency - minimal insulation, no weatherproofing or storm windows (older homes, shops or greenhouses)
** Suggested average outside temperatures:
WINTER
4 deg F Boise
6 deg F Grand View
-8 deg F Cascade
SUMMER
80 deg F Boise
90 deg F Grand View
70 deg F Cascade
