

BROCKWAY
ENGINEERING
P.L.L.C.

Hydraulics

Hydrology

Water Resources

October 19, 2009

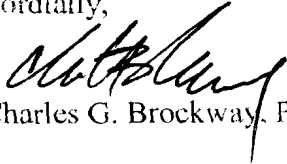
Mr. Allen Merritt
Idaho Department of Water Resources
1341 Fillmore Street, Suite 200
Twin Falls, ID 83301

Re: Permit 37-8205 / Beneficial Use Exam
Project No. 337-07-2000

Dear Allen:

Enclosed please find a Proof of Beneficial Use and two (2) copies of a beneficial use field report for the above-referenced permit. Because the proof date for this permit fell on a Saturday, Rule 56 of the Rules of Procedure allows the proof and field report to be submitted today. If I can clarify any point of the report or provide any other needed technical information, please let me know.

Cordially,


Charles G. Brockway, P.E.

Enc. Proof of Beneficial Use
IDWR Form - Beneficial Use Field Report
Beneficial Use Report for Permit 37-8205

Cc: Donna Kelsey
Ed Lawson

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

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

2016 NORTH
WASHINGTON
STREET • SUITE 4

TWIN FALLS,
IDAHO 83301

208•736•8543

FAX: 736•8506

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STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

For Office Use Only

Amount of Fee \$: _____
Date Received: _____
Receipt by: _____
Receipt No.: _____

PROOF OF BENEFICIAL USE

The Idaho Department of Water Resources considers this form a statement that the permit holder(s) has/have completed all development that will occur under this permit and that water has been applied according to the provisions of the permit for the beneficial use(s) described below. This form must be accompanied by a license examination fee, when necessary, or be accompanied by a completed field examination report prepared by a certified water right examiner.

1. Permit No.: 37-8205 Telephone No.: (208) 726-4113
2. Name of Permit Holder(s): Sun Valley Land & Minerals, Inc.
3. Mailing Address: P.O. Box 1959
City: Sun Valley State: ID Zip: 83353
4. Source of Water: Groundwater If **GROUNDWATER** (well), Date Drilled: mo. various / yr. _____
Well Driller: Hiddleston Drilling Drilling Permit No.: various
5. Use(s) (as authorized by the water right permit):
Domestic (No. of households): _____ Stockwater (No. and type of stock): _____
Irrigation (No. of acres): _____ Other: Heating & Recreation
6. Total rate of diversion and/or volume for which proof is submitted: 2.5 cfs OR _____ acre-feet
7. Measuring Device Requirement: **(refer to the approval conditions on your permit and respond accordingly)**
(This question is **not optional**. Please check either yes or no. Proofs returned not checked accordingly, will be considered incomplete)
Measuring Device: Is a measuring device required? ☐ Yes or ☒ No
Has the measuring device been installed? ☒ Yes or ☐ No
8. Fee Enclosed: \$ _____ (See Fee Schedule on back of the instructions for filing proof of beneficial use.)
9. Person to contact to accompany the Department representative during field examination of the water system.
Name: _____ Telephone Number: _____
Address: _____
10. **The information given on this form is my true statement of the extent to which the above numbered permit has been developed and water has been diverted. I agree to relinquish any underdeveloped portion of the permit to the State of Idaho.**

Signature of permit holder: Norman Kelsey, President of Date: 10-16-09
(include your title, if on behalf of company or organization)
Sun Valley Land & Minerals, Inc.

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

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A. GENERAL INFORMATION

Permit No.: 37-8205

1. Owner: Sun Valley Land & Minerals, Inc.

Phone No.: (208) 726-4113

Current Address: P.O. Box 1959, Sun Valley, ID 83353

2. Accompanied by: Donna Kelsey, owner; Mike Evans, contractor

Exam Date: 10/13/09

Address: _____ Phone No.: _____

Relationship to Permit Holder: As noted

3. Source: Groundwater tributary to _____

B. OVERLAP REVIEW

1. Other water rights with the same place of use: See narrative

2. Other water rights with the same point of diversion: See narrative

C. DIVERSION AND DELIVERY SYSTEM

1. Point(s) of Diversion:

Ident No	Gov't Lot	1/4	1/4	1/4	Sec.	Twp.	Rge.	County	Method of Determination / Remarks
			SW	SE	27	3N	17E	Blaine	GPS / aerial photo
			SW	SE	27	3N	17E	Blaine	GPS / aerial photo
			SW	SE	27	3N	17E	Blaine	GPS / aerial photo

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

TWP	RNG	SEC	NE				NW				SW				SE				TOTALS
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
3N	17E	27															X	X	

X = Heating and Recreation

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

See Report and Map

- ☒ 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
Well #3	Franklin	15		Goulds	250L15
Well #75-1	Franklin	20		Goulds	320L20
Well #11	Franklin	20		Goulds	320L20

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calibration
In-line meter		McCrometer	MF-100		8"	New

2. Measurements: See report

E. NARRATIVE / REMARKS / COMMENTS

See report

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

F. FLOW CALCULATIONS

☒ Additional Computation Sheets Attached

Measured Method: See report

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:

See report

H. RECOMMENDATIONS

1. Recommended Amounts

Beneficial Use	Period of Use		Rate of Diversion Q (cfs)	Annual Volume V (afa)
	From	To		
<u>Heating</u>	<u>1/1</u>	<u>12/31</u>	<u>0.84</u>	<u>122.1</u>
<u>Recreation (or Heating)</u>	<u>1/1</u>	<u>12/31</u>	<u>1.39</u>	<u>819.9</u>
_____	_____	_____	_____	_____
TOTALS:			<u>1.76</u>	<u>942.0</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

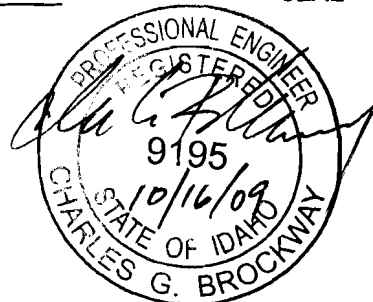
Field Examiner's Name: Charles G. Brockway

Date: 10/16/09

Reviewer: _____

Date: _____

SEAL



Project No. 337-07-2000

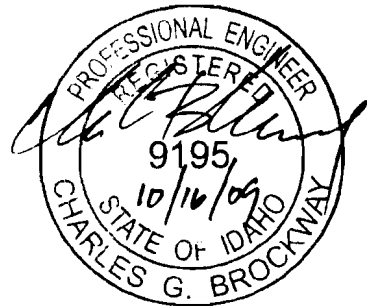
Beneficial Use Field Report for Permit 37-8205

Prepared for:

Sun Valley Land & Minerals, Inc.

October 16, 2009

For information concerning this report, contact
Charles G. Brockway, Ph.D., P.E.



BROCKWAY
ENGINEERING
P.L.L.C.

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

2016 NORTH WASHINGTON, SUITE 4
TWIN FALLS, IDAHO 83301

Beneficial Use Report for Permit 37-8205 Sun Valley Land & Minerals

Brockway Engineering, PLLC
Charles G. Brockway, P.E.

October 16, 2009

A. Administrative Overview

This permit authorizes diversion of geothermal water from up to six (6) wells for heating and recreational purposes. The permit authorizes 5.0 cfs for each use, with the total limited to 5.0 cfs. No annual volume limitation is shown on the permit.

The permit was originally approved in 1985, and has been the subject of multiple extensions of time to submit proof of beneficial use. The last extension was granted on April 13, 2006 which extended the proof date to October 17, 2009.

An amendment of the permit was approved on March 20, 2009, which changed the points of diversion to agree with existing and planned wells to allow drilling permits to be granted. A petition for reconsideration of this amendment was denied. Another amendment of the permit is pending as of this date. The purpose of this amendment was to modify language on the permit regarding nature of the facilities anticipated to be served by the geothermal water.

Charles G. Brockway, Ph.D., P.E. was the design engineer for the geothermal development project. As such, Dr. Brockway has been on the site numerous times during the planning, design, and construction phases. The contractor for the project was Katco Excavation of Bellevue, Idaho. The official beneficial use exam took place on October 13, 2009. At this time, it was found that the construction was complete and the only work left to do consisted of minor punch-list items that do not relate to the ability to deliver and use the water.

B. Description of System

The water diversion and delivery system consists of three pumped geothermal wells delivering hot water to a distribution network for three beneficial uses: 1) maintaining an outdoor heated pond/spa recreational facility; 2) melting snow on the roadways within the project by the direct-use hydronic method using a network of buried radiators; and 3) heating two small residences on the property.

The proposed development plan for the geothermal water was described in detail in an engineering report by Brockway Engineering dated June 8, 2009. This report was submitted to the Department for the purpose of review and comment, and contains detailed information regarding the well drilling, well testing, aquifer hydrogeology, system hydraulics, heat loss calculations, and climatologic data. Since the report is contained in the Department's files, much of the detailed information will not be repeated here. The

engineering report also contains large-format drawings representing the development plan; the actual system as constructed does not differ significantly from these plans. As-built drawings are in the process of being created, and will be submitted to the Department upon completion.

The attached aerial map illustrates the major components of the system.

C. Other Related Water Rights

Several other rights exist on the property, related to both the geothermal system and cold water usage from Deer Creek. All rights have been recommended in the SRBA.

The existing pool / spa is part of a multiple-pond system which is authorized by water rights 37-2446 and 37-4369 from Deer Creek. These rights originally pertained to the original Clarendon Reservoir, which was a single impoundment. A transfer approved in 2003 allowed restructuring of the pond system upstream of the on-stream embankment, and also allowed impoundments to take place off stream.

Water right 37-22128 authorizes geothermal diversion from five (5) wells for the purposes of irrigation (1 acre and 0.03 cfs), heating (0.13 cfs and 40 afa), and recreation (0.13 cfs and 24 afa). Two of the five wells (Well #3 and #75-1) are the same as those on permit 37-8205. This right is unrestricted as to consumptive use.

Water right 37-4368B authorizes geothermal diversion from springs within the main development area in the SWSE Sec. 27 for the purposes of heating (0.13 cfs), and recreation (0.13 cfs), with a total of 0.13 cfs. This right is unrestricted as to consumptive use or diversion volume.

Water right 37-4100 covers an artesian well located in NENW Sec. 34, some distance from the main development. This well serves a swimming pool and the source is the same limestone aquifer as the other wells, but the well is not connected by pipeline to the main development or the water system under permit 37-8205.

Water right 37-21614 authorizes cold water usage from Deer Creek for recreational purposes (0.24 cfs). This right is pumped from Deer Creek for the same pool covered by hot water right 37-4100. The right is unrestricted as to consumptive use or diversion volume.

No combined-use conditions are found on any of the above recommendations.

D. Water Sources

The sources for the geothermal water under permit 37-8205 are three 8-inch wells located on the permittee's property. These wells are cased through the upper alluvial strata, typically 30 to 50 feet thick, and are open to the limestone formation which bears the geothermal water. Beneath the limestone at approximately 160 to 200 feet below

ground a granite basement formation exists. All wells were drilled through the limestone to reach the granite. Geothermal water within the limestone is under artesian pressure. Aquifer testing conducted in 2008 and 2009 by Brockway Engineering confirmed that all three wells are tapping the same aquifer, or zone of fracturing, within the limestone formation.

Well #3R is a replacement well for an old well designated as Well #3 at the same location. The new well was drilled approximately 10 feet from the old well. The old well was abandoned by filling it with bentonite. Well #75-1 was originally drilled in 1975. This well was enlarged to 8" diameter and deepened to reach the granite formation. Well #11 is a new well drilled in 2009. The location of this well was selected based on an analysis of the subsurface geology, particularly the zones of fracturing within the limestone, utilizing lithologic records from numerous wells that have been drilled on the property over the last 30 years. Well #11 proved to be the most productive well of the three and flowed 102 gpm under artesian pressure at the time of drilling. Well drilling records are included in Appendix A.

Well #3 and #11 were tested utilizing a submersible pump and portable generator. The tests consisted of a controlled step-drawdown test with a total duration of 6 hours. Well 75-1 was tested by blowing air with the drill rig, collecting the discharge from the well into a channel, and measuring the flow with a portable flume.

Pertinent characteristics of each well are provided in Table 1.

Table 1. Well information.

	Well #3R	Well #75-1	Well #11
Date drilled or modified	12/17/2008	12/8/2008	1/22/2009
Total depth (ft)	200	185	160
Depth to bottom of water-bearing limestone (ft)	183	177	146
Artesian flow (gpm)	30 (est.)	45 (est.)	102
Maximum pumped capacity (gpm)	200	275	315
Water temperature (°F)	127	127	114
Installed pump	15HP	20HP	20HP

Each wellhead was completed with a blank flange seal, a pitless adapter, and a buried resilient-wedge gate valve on a length of ductile-iron pipe extending from the casing. A pressure gauge and air-vacuum valve was installed on the top of the casing. A bypass pipe and valve from the casing above ground to the buried ductile iron pipe was installed to allow artesian flow to discharge unimpeded from the well, if desired, without activating the pump. The artesian pressure on the wellheads at the time of the exam was zero, as the water level in the wells was drawn down by the pumps.

The pumps in the wells are variable-speed units operated according to the water level in the collection box as described below.

E. Distribution System

Buried pipelines from the three wells extend to a concrete collection box near Well 75-1. Upstream of the box, the pipes from the wells are manifolded to a single 8-inch pipe. A McCrometer propeller meter is located in this pipe with sufficient clear distance upstream and downstream of the meter.

Exiting the collection box is a 6-inch PVC mainline which runs from the box to the recreational pond & spa. Approximately midway along this pipe is a manifold which feeds eight (8) separate zones for the roadway snowmelting network. There is a fall of about 60 feet from the collection box to the spa. The 6-inch mainline is kept full and pressurized by throttling a valve located at the end of the mainline where it discharges to the pond. In this way, approximately 15 to 20 psi is maintained for the snowmelting system and the water depth in the collection box is maintained from 3 to 4 feet. The flow within each snowmelting zone is regulated using valves at the tailpipe from each zone. Any zone can be completely shut off by closing valves at the main manifold. Discharge from the tailpipes of Zones 1, 3A, and 3B returns to the main reservoir; discharge from Zones 2, 4A, 4B, and 4C returns to the heated pool / spa.

The variable-speed drives on the well pumps are programmed to operate according to the water depth in the box. If the demand downstream in the system increases, the box level will drop and the pumps will increase speed to maintain the level. If demand decreases, the pumps will decrease speed. The pumps are programmed with the following set points:

Pump #1 (Well 75-1):	32" Lag 2
Pump #2 (Well 3):	42" Lag 1
Pump #3 (Well 11):	48" Lead

The water supply and distribution components are illustrated on the attached aerial map.

F. System Capacity Measurements

The flow rate from the wells was measured using the installed McCrometer meter. In addition, a Fuji Portaflow X meter was installed on the same pipe just upstream of the meter. However, due to air within the pipe, a consistent reading could not be obtained at all flows. Therefore, the McCrometer meter was presumed to be the more accurate meter, being new and installed properly in the pipe.

Prior to the date of the beneficial use exam, the wells had been run continuously for approximately 2 weeks at a total flow rate of about 550 gpm, which was less than the total well capacity because the pump speed was set at 80% of maximum. On the date of the exam, the wells were turned off at 7:30 am. However, by 10:30 am the wells had not recovered to their previously artesian condition.

F.1. Condition #1: All water to pond.

Under this condition, the capacity of the 6" pipe greatly exceeds the capacity of the wells due to the large elevation drop from the box to the pond; hence the valve at the pond must be throttled to keep the pipe and box full, and the flow meter operating properly. When activated, the wells initially discharge 790 gpm, which declined slowly as the drawdown in the wells increased, as follows:

Time	Flow
11:40	All wells at full speed
11:44	790 gpm
11:49	750 gpm
12:16	690 gpm
12:19	710 gpm
12:33	680 gpm
13:00	665 gpm

From 12:34 to 12:44 a 10-minute totalizer reading was taken and the average flow found to be 663 gpm. From this test it can be concluded that the initial capacity of the well field is 790 gpm (1.76 cfs) and the sustained capacity is 663 gpm (1.48 cfs). Although not confirmed by a test, the length of the transient period before the sustained capacity is reached is likely to be much longer if the wells have not been pumped recently and are flowing under artesian pressure when the pumps are started. The diversion rate on the water right should recognize the initial capacity so that the transient period is covered and does not result in a violation of the diversion rate.

F.2. Condition #2: All water to snowmelting

The valve at the pond was closed and all water was directed to the snowmelting system. It was confirmed that the capacity of the snowmelting system with all zones operating greatly exceeds the output of the wells, and the tailpipe valves needed to be throttled to the nearly closed position in order to maintain a water level in the collector box. The valves were initially throttled to about $\frac{3}{4}$ closed, which resulted in a flow from the wells of 620 gpm. With the valves throttled to nearly closed, the pumps reduced speed further and the flow rate to the snowmelting system was approximately 470 gpm.

G. Beneficial Use Calculation – Diversion Rate

The peak diversion rate to be licensed should be based on the maximum flow rate that will be required under conservatively high short-term demand conditions. Refer to the engineering report for more information on this calculation and justification of the assumptions made for each use. Pond heat losses were calculated using the GeoHeat center spreadsheet tool. Snowmelting flow requirements were based on Lund (2000). Residential heating requirements were based on the IDWR spreadsheet tool developed for this purpose. Minor updates in climatic parameters have been made and the updated spreadsheets are provided in Appendix B.

The surface area of the pond / spa was calculated from the 2006 aerial photo to be 1.17 acres. Areas of the snowmelting zones were calculated based on the survey site plan and topographic map described in the engineering report, and roadway widths were spot-checked by field measurements to ensure that the areas were accurate. The width of the roadmix placed over the radiator pipes ranged from 16 feet to 21 feet. The snowmelting area includes a pathway leading to the terrace, and the terrace itself. This path was designed to be 5 feet wide but was actually built as 8 feet to 11 feet wide. A tabulation of areas is provided in Table 2.

Table 1. Snowmelting zone areas.

Zone	Area (ft2)
1	6,592
2	3,927
3A	4,773
3B	2,944
4A	5,940
4B	4,860
4C	4,220
Path & Terrace	5,666
TOTAL	38,922

Two residences are being served by the geothermal system. One residence is the caretakers house, with a footprint of approximately 888 ft2. The other is a bath house of approximately 507 sq. ft. Both of these structures are single-story and poorly-built with poor insulation value.

Table 3 shows the required diversion rates based on the spreadsheet calculations, and a brief summary of the assumptions made.

Table 3. Summary of calculated diversion rate requirements.

Use	Peak Requirement	Comments / assumptions
Heated pond / spa	622 gpm (1.39 cfs)	Maintain 85F in pond, January conditions, average wind velocity, 80% exceedance level of minimum January temperature
Snowmelting system	382 gpm (0.85 cfs)	January conditions, 90% exceedance level daily snowfall occurring over 4 hours, snow density 0.1, average wind speed, effluent temperature 70F
Residential heating	14.4 gpm (0.032 cfs)	888 sq. ft. residence and 507 sq. ft. bath house, single-story, poor efficiency, inside temperature 72F

The sum of the diversion rates in Table 3 is 2.23 cfs, but total diversion rate should be limited to the transient capacity of the well supply sources, or 1.76 cfs.

H. Beneficial Use Calculation – Annual Diversion Volume

The annual diversion volume requirement for each beneficial use was not addressed in the engineering report, and so the calculation methodology is described here.

H.1. Heated pond/spa

The annual diversion volume to be licensed is the amount needed on an annual basis to maintain the target pond temperature of 85F under assumed climatic conditions. It is assumed that the flow to the pond will be regulated in order to maintain the pond temperature near this target value.

To make this calculation, a monthly analysis of pond heat losses and flow requirement was made using average values of temperature, relative humidity, and wind speed at the Hailey 3NNW station. Since the licensed diversion volume must be large enough to cover years with demand higher than average, an argument could be made for using something more conservative than average monthly climatic data. However, a cursory sensitivity analysis with the heat loss calculations shows that the heat balance can be maintained even under more extreme conditions with only 2 to 3 degrees drop in pond temperature, which cannot be discerned by a human swimmer. Therefore, the use of average values is reasonable. The calculations are shown in Appendix B.

Temperature data was obtained from the Western Regional Climate Center (WRCC) for the NWS station Hailey 3NNW. Data on wind speed is also compiled by WRCC but reflects data collected at the Hailey airport AWOS station. Relative humidity data for a long period of record at Hailey was not found; however, average monthly data from the NCDC for Boise was assumed to be applicable to Hailey. The pond heat loss calculation is very insensitive to humidity level, so the lack of site-specific data is not crucial.

The total annual volume requirement for the pond / spa is 819.9 acre feet.

H.2. Snowmelting system

The snowmelting system will operate at a fixed flow rate. The tailpipe valves will be set so that the flow rate is approximately 364 gpm, the maximum that would be required to melt the design snowfall event. The system flow cannot feasibly be adjusted to exactly match the heat requirement of the many snowstorms that will occur over a given year. Instead, the system will be turned on whenever snowmelting is required, and turned off whenever the snowfall ceases or snowmelting is no longer required. Given this method

of operation, the annual volume that should be licensed is best calculated by estimating a conservatively high number of days each year that the system will be operated.

The number of days of snowfall for each month is not readily available for the Hailey 3NNW station. However, daily snowfall data is available at the the NRCS snotel sites at Hyndman and Dollarhide Summit, located 16.5 miles and 12.8 miles, respectively, from the project site. This data was analyzed and a frequency analysis performed. Both data sets exhibited a probability distribution with bi-modal characteristics and could not be fitted with a standard probability distribution; therefore frequencies were determined by the plotting position method. The data is provided in Appendix B and the results shown in Table 3.

Table 4. Number of days of snowfall from November – March at NRCS snotel sites.

	Hyndman	Dollarhide Summit
Mean	49.0	64.2
Standard deviation	10.1	12.8
Exceedance probability:		
0.5	51	61
0.75	58	74
0.8	59	76
0.9	62	82
0.95	63	85

The 90% level was selected as a reasonable criteria to ensure that the annual licensed volume is sufficient. Due to its lower elevation, the Hyndman site is likely a better representative of the project site conditions even though it is farther from the site. Therefore, the volume calculation was based on 62 days per year of snowfall.

A diversion rate of 382 gpm operated over 62 days per year yields an annual volume of 104.7 acre-feet.

H.3. Residential heating

Annual volume for residential heating was calculated using the same IDWR spreadsheet used to calculate the instantaneous flow rate described above. The number of heating days per year was assumed to be 273, which represents the period September through May. The annual volume is 17.4 acre-feet.

I. Summary of Findings

- The capacity of the source (well field) is 1.76 cfs (transient) and 1.48 cfs (sustained).
- The capacity of the distribution system is much greater than the source capacity.

- The justifiable beneficial use for the heated pond / spa is 1.39 cfs and 819.9 afa.
- The justifiable beneficial use for the snowmelting system is 0.81 cfs and 99.7 afa.
- The justifiable beneficial use for the residential heating is 0.032 cfs and 17.4 afa.

J. Licensing Recommendations

J.1. Water right components & amendments needed

The diversion rates and volumes for each beneficial use should be equal to the actual required amounts calculated above. The category "heating" is assumed to include the residential heating and the snowmelting system. The category "recreation" is assumed to cover the heated pond / spa. However, this use could also plausibly be covered under "heating" also. Based on the evaluations and measurements described above, the maximum instantaneous diversion rate from the wells should be 1.76 cfs.

Heating (residential)	0.032 cfs	17.4 afa
Heating (snowmelting)	0.81 cfs	104.7 afa
Recreation or Heating (pond / spa)	1.39 cfs	819.9 afa
TOTAL	1.76 cfs	942.0 afa

Only three of the six authorized wells are used for the geothermal system under this permit. Therefore, a licensing amendment is needed to list three (3) wells in SWSE Section 27. GPS points for these wells are as follows:

Well #3	43.559750	-114.415267
Well #75-1	43.559700	-114.415100
Well #11	43.559133	-114.415417

The place of use of the water usage is located within SWSE Sec. 27 and SESE Sec. 27. A licensing amendment is needed to delete the unused 40s.

J.2. Analysis of Permit Conditions

Conditions 1, 2, 4, 5, 6, and 9 appear to have been satisfied.

Condition No. 3 pertains to consumptive use. This condition requires that the right be non-consumptive, and that "If use is found to be consumptive in the future, the consumption must be replaced or the user of the water must cease diversion until a plan of replacement is implemented." This unusual condition does not appear to encumber the licensing process, but only provides for a stop-gap measure in the future if the use is found to be consumptive. Department staff have previously indicated that a potential increase in evaporation from the pond due to the introduction of heated water may need to be considered in evaluating whether 37-8205 can be considered non-consumptive.

The permittee has indicated that water right 37-22128 or 37-4368B will be made available for mitigation purposes, if required by the Department. Both rights allow geothermal water from the same source, are unrestricted as to consumptive use, and therefore could be 100% consumptive.

Condition Nos. 7 and 8 describe potential uses for the geothermal water based on the original application in 1985. The actual uses which have been developed differ significantly from these descriptions but are still covered under the legal components of the water rights, namely heating and recreation. The original permit did not restrict the annual volume that could be developed and therefore the actual developed uses should be licensed.

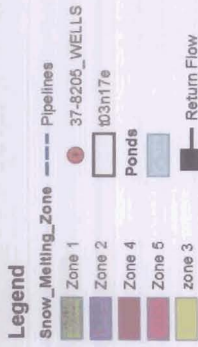
SESE Sec. 27

SWSE Sec. 27



1 inch equals 100 feet

SUN VALLEY LAND & MINERALS
PERMIT 37-8205 BENEFICIAL USE EXAM
NAIP 2006 AERIAL PHOTO



Appendix A
Well Drilling Records

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

RECEIVED
JAN 6 2009
DEPT. OF WATER RESOURCES
SOUTHERN REGION

1. WELL TAG NO. D 0050560

Drilling Permit No. 854188 appl. 906784

Water right or injection well # 37-8205

2. OWNER

Name Sun Valley Land & Minerals Inc.

Address PO Box 1959

City Sun Valley State ID Zip 83353

3. WELL LOCATION:

Twp. 3 North ☒ or South ☐ Rge. 17 East ☒ or West ☐

Sec. 27 1/4 SW 1/4 SE 1/4

Gov't Lot County Blaine

Lat. (Deg. and Decimal minutes)

Long. (Deg. and Decimal minutes)

Address of Well Site Clarendon Hot Springs

City

Lot Blk. Sub. Name

4. USE:

☐ Domestic ☐ Municipal ☐ Monitor ☐ Irrigation ☐ Thermal ☐ Injection

☒ Other Heating and Recreation

5. TYPE OF WORK check all that apply (Replacement etc.)

☐ New Well ☒ Replacement well ☒ Modify existing well

☐ Abandonment ☐ Other

6. DRILL METHOD:

☒ Air Rotary ☐ Mud Rotary ☐ Cable ☐ Other

7. SEALING PROCEDURES

Seal material	From (ft)	To (ft)	Quantity (lbs or ft ³)	Placement method/procedure
Cement	0	30	1692 lbs.	Tremmie from bottom up

12. STATIC WATER LEVEL and WELL TESTS:

Depth first water encountered (ft) 38 Static water level (ft)

Water temp. (°F) 126 Bottom hole temp. (°F)

Describe access port

Well test: Test method:

Drawdown (feet)	Discharge or yield (gpm)	Test duration (minutes)	Pump	Bailer	Air	Flowing artesian
140 ft	170 gpm	360	☒	☐	☐	☐

13. LITHOLOGIC LOG and/or repairs or abandonment:

Bore Dia. (in)	From (ft)	To (ft)	Remarks, lithology or description of repairs or abandonment, water temp.	Water Y N
12	0	9	Cobbles, Sand & Gravel	x
12	9	30	Gray Limestone	x
8	30	38	Gray Limestone	x
8	38	42	Gray Limestone / fractures	x
8	42	130	Gray Limestone	x
8	131	140	Gray Limestone / fractures	x
8	140	159	Dark Gray Limestone	x
8	159	183	Gray Limestone	x
8	183	200	Granite	x

14. DRILLER'S CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Company Name Hiddleston Drilling Co. No. 35

*Principal Driller Date 12/31/08

*Driller Date

*Operator II Date

Operator I Date 1/21/09

* Signature of Principal Driller and rig operator are required.

RECEIVED

JAN 22 2009

WATER RESOURCES
WESTERN REGION

Completed Depth (Measurable) 200

Date: Started 12-10-08 Completed 12-17-08

Appendix B
Heat Loss, Flow Rate, & Volume Calculations

SUN VALLEY LAND & MINERALS**OPEN POND HEAT LOSS CALCULATION - PEAK FLOW REQUIREMENT****Permit 37-8205****OIT Geoheat Center Tools****CGB 10/14/09 As-Built Conditions**

Parameter	Value	Units	Assumptions / Remarks
1. Resource temp	124.7	F	Measured mixed temperature 10/13/09
2. Length	370	ft	Pond length avg
3. Width	138	ft	Pond width avg
4. Water temp in pond	85	F	Pleasant temperature for bathing/swimming
5. Wind velocity	4.1	mph	Average January wind speed at Hailey
6. Air temp	-1.7	F	80% exceedance minimum temp at Hailey
7. Cover thickness	0	in	No pond cover
8. Cover "k"	0.4	btu in/hr sqft F	Value irrelevant since thickness = 0
9. Relative humidity	65	%	Average January humidity at Boise
10. Calculated water vap pres	0.589	psia	
1. Evaporative Loss	4528828	btu/hr	88.7 btu/hr sqft
2. Convective Loss	4031412	btu/hr	79.0 btu/hr sqft
3. Radiant Loss	3644396	btu/hr	71.4 btu/hr sqft
4. Conductive Loss	146067	btu/hr	2.9 btu/hr sqft
5. Total Loss	12350704	btu/hr	241.9 btu/hr sqft
6. Required flow rate	622.2	gpm	

ha	0.910662	Pond surface area	51060 ft2
x/k	0		1.17 acres
p. press	0.020		
area	51060		
surf temp	85		
U	0.910662		

SUN VALLEY LAND & MINERALS
ROADWAY SNOW MELTING WITH GEOTHERMAL WATER - PEAK FLOW REQUIREMENT
Permit 37-8205
As-built condition as of 10/13/09

Lund, John W. (2000). Pavement Snow Melting. Geo-Heat Center Bulletin.
Assumes direct-use hydronic method, buried pipelines

FIRST USE OF WELL DISCHARGE

DESIGN CONDITION

Parameter	Value	Units
Total area	38,922	ft ²
Rate of snowfall water equiv. per hr	0.17	inch/hr
Air temperature	-1.7	F
Wind speed	4.1	mph
Water film temperature	33	F
Ratio of snow-free area to total	1	
Resource temperature	124.7	F
Effluent temperature	70	F
Road pavement heat loss	20%	

CALCULATIONS

Vapor pressure of air	0.06	in Hg
Heat of vaporization at film temp	1075.5	Btu/lb
Sensible heat	14.8954	Btu/hr/ft ²
Heat of fusion	126.82	Btu/hr/ft ²
Heat of evaporation	18.67041	Btu/hr/ft ²
Heat transfer (conv. & radiation)	54.35665	Btu/hr/ft ²

Unit heat required at road surface	214.7	Btu/hr/ft ²
Unit heat required from pipes	268.4	Btu/hr/ft ²
Total heat required	10447757	Btu/hr
Flow rate required	382	gpm

RESIDENTIAL SPACE HEATING/COOLING REQUIREMENTS FOR COLD OR GEOTHERMAL SOURCES

Worksheet created by Cindy Hodges, 11/93.

Project: SUN VALLEY LAND & MINERALS

Data entered by: C. G. Brockway
Exam Date: 10/13/09 House 888 sq ft
File No: 37-8205 House 0 sq ft
Computations for: Heating Employee house 0 sq ft
Bathroom 507 sq ft
Other 0 sq ft
Total 1395 sq ft

REQUIRED DATA:

Area of livable floor space, ft2 (A) 1395
2 story? (N=1, Y=2) 1
House efficiency factor (e) * 1.11
Inside design temperature (Ti) 72
Average outside temperature (To) ** -1.7
Source temperature, degrees F (S) 124.7
Heating/cooling days per season (D) 273
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 = 114,121 BTU/hour

TEMPERATURE DROP ACROSS SYSTEM

Formula: $T_s = 0.3 \times [S - Ti]$

Ts = 15.81 degrees F

FLOW RATE REQUIRED (at given source temperature)

Formula: $Q = E / (500 \times Ts) \times 448.8$

Q = 0.032 cfs
14.4 gpm

DIVERTED VOLUME OVER SEASON

Formula: $V_{div} = Q \times D \times H / 24 \times 1.9835$

Vdiv = 17.4 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

SUN VALLEY LAND & MINERALS
OPEN POND HEAT LOSS - MONTHLY & ANNUAL VOLUME REQUIREMENT
Permit 37-8205
OIT Geoheat Center Tools
CGB 10/14/09 As-Built Conditions

Average climatic conditions

Resource temperature 124.7 F

Target pond temperature 85 F

Month	No. Days	Wind Speed (1)	Air Temp (2)	Relative Humid (3)	Average flow requirement (4)	Volume (ac-ft)
January	31	4.1	19.3	74	524.6	71.9
February	28	4.6	24.1	68	536.6	66.4
March	31	5.9	31.0	58	585.9	80.3
April	30	6.7	42.6	52	559.1	74.1
May	31	7.6	51.7	49	537.6	73.7
June	30	7.7	58.8	47	485.2	64.3
July	31	8.1	67.5	38	439.1	60.2
August	31	7.9	66.0	38	444.2	60.9
September	30	7.5	56.7	45	497.5	66.0
October	31	6.4	46.5	52	515.0	70.6
November	30	4.5	33.0	67	481.9	63.9
December	31	3.9	22.3	74	495.1	67.8
TOTAL						819.9

(1) Average monthly wind speed at Hailey airport AWOS [mph]

(2) Average monthly temperature at Hailey NWS [degrees F]

(3) Average monthly relative humidity at Hailey airport for 1/1/2007 - 10/13/2009 [%]

(4) Estimated by OIT GeoHeat Center tool [gpm]

NUMBER OF DAYS OF SNOWFALL, NOVEMBER - MARCH
NRCS SNOTEL SITES

Brockway Engineering 10/16/09

Water Year	No. Days Snow	
	Hyndman	Dollarhide
1982		85
1983		90
1984		64
1985		58
1986		76
1987		53
1988		66
1989	63	70
1990	39	55
1991	39	51
1992	46	53
1993	61	46
1994	38	45
1995	64	84
1996	58	71
1997	59	81
1998	40	62
1999	62	75
2000	53	47
2001	35	59
2002	42	59
2003	51	60
2004	46	60
2005	32	47
2006	55	78
2007	41	58
2008	54	71
2009	52	74

STATISTICS:

	Hyndman	Dollarhide
Mean	49.0	64.2
Std dev	10.1	12.8
Ex prob:		
0.5	51	61
0.75	58	74
0.8	59	76
0.9	62	82
0.95	63	85

Appendix C
Photographs



Well #3



Well #11, looking north

Permit 37-8205 Beneficial Use Exam / Sun Valley Land & Minerals



Well #75-1, looking south



Control house (left), Well #75-1 (left of center), and collection box (right)

Permit 37-8205 Beneficial Use Exam / Sun Valley Land & Minerals



Flow meter on inlet pipeline to collection box
Portable ultrasonic meter installed for comparison



Variable-frequency controller and 3-phase converter



Pond / Spa, pathway, and terrace



Pond / Spa

Permit 37-8205 Beneficial Use Exam / Sun Valley Land & Minerals



Snowmelting Zone 1 (west part)



Snowmelting Zone 1 (east part)

Permit 37-8205 Beneficial Use Exam / Sun Valley Land & Minerals



Snowmelting Zone 2



Snowmelting Zone 3A



Snowmelting Zone 3B



Pathway snowmelting zone, also shows inlet to pond / spa



Snowmelting Zones 4A, 4B, 4C



Return to pond for snowmelting Zones 2, 4A, 4B, 4C



Discharge to pond / spa



Terrace & steps – access to pond / spa

Permit 37-8205 Beneficial Use Exam / Sun Valley Land & Minerals



Pond / spa, terrace, path, and return pipes (looking west)



Main manifold. 4" valves to snowmelting system; 6" valve in mainline to pond.



Valves on either side of terrace allow introduction of hot water directly at the step area.



Example of snowmelting zone header (photo date 9/15/09)



Example of snowmelting radiator placement (photo date 9/15/09)