



RECEIVED

JUN 22 2007

WATER RESOURCES
WESTERN REGION

June 20, 2007

Dan Nelson
Idaho Dept. of Water Resources
Western Region Office
2735 Airport Way
Boise, ID 83705-5082

Re: Boise State University Application for Permit for Cooling

Dear Dan,

Boise State University (BSU) has applied for a permit to develop a water right for cooling purposes in three buildings on its Boise campus. These buildings are the Liberal Arts Building, Special Events Center and the Hemingway Western Studies Center. This letter is a response to your correspondence dated March 30, 2007. You requested additional information concerning:

1. The instantaneous diversion rate required for the cooling system,
2. The non-consumptive nature of the proposed water use, and
3. The need for a stream-channel alteration permit at the discharge point.

Instantaneous Diversion Rate

As you state in your letter, the application represents a use that has already been developed. The application diversion rate is based on the capacity of the replacement pump installed in 1988, a 7.5 hp Sta-Rite submersible pump (Model 190K6) rated to produce 190 gpm (0.42 cfs) at 100 feet TDH. The pump is set at 96 feet. The static water level in 1988 was 20 feet.

Cooling is achieved with a Chrysler Air Temperature Chiller, operated to produce a constant water discharge temperature of 90°F through use of a modulating valve. During cooler weather, the pump produces at lower rates and higher discharge pressures. During hot weather, the pump produces at higher rates and lower discharge pressures. Minimum discharge pressure is estimated at 20 psi. Assuming a pumping water level of 50 feet and a few feet of friction loss in the column pipe and valves, the TDH would be approximately 100 feet and the diversion rate would be approximately 0.42 cfs.

Proposed Use is Non-Consumptive

The Liberal Arts Cooling well taps what we believe to be a semi-confined aquifer zone found at a depth of approximately 170 feet. This water-bearing zone is located beneath the shallow unconfined alluvial aquifer that is in direct hydraulic connection with the Boise River. The semi-confined aquifer is almost certainly recharged from

the overlying alluvial aquifer (water-level data from a piezometer nest located east of BSU and just north of the Boise River in Boise's Municipal Park clearly demonstrate a downward hydraulic gradient – Figure 1). The water-bearing zone discharges to the alluvial aquifer in other areas (generally north and west of BSU where there is an upward vertical gradient).

The driller's report for the Liberal Arts Cooling Well describes a clay layer separating the alluvial aquifer from the water-bearing zone. However, recharge from the shallow alluvial aquifer in this area of downward hydraulic gradient is likely for several reasons. First, although a blue clay transition is noted throughout wells in the Treasure Valley, individual clay layers are not necessarily areally extensive (Petrich and Urban, 2004). Second, it is our experience that clay layers, especially shallower clay zones in the eastern portion of the valley, may have fine sand or silt layers interbedded within the clay that provide conduits for net vertical ground water movement. Finally, tilted strata (Wood and Clemens, 2004) and/or faulting or facies changes near the basin margins also likely contribute to downward ground water flow in the BSU vicinity.

The BSU cooling well draws water from 160 to 173 feet. With the exception of measurements taken on June 12, 2003, the water levels from Municipal Park piezometers (Figure 1) completed at intermediate depths (33N02E-14ABC 2 and 3, which have open intervals at 190 to 210 feet and 300 to 320 feet, respectively) exhibit water level patterns more similar to the shallowest piezometer (33N02E-14ABC1 – completed between 35 to 50 feet) than deeper zones. (The deeper zones show the influence of irrigation pumping). Similarity in water levels between shallow- and intermediate-depth aquifer depths in this area indicated hydraulic connection between shallow and intermediate zones.

Water levels in the Municipal Park wells, located northeast of the BSU campus, have stable water-level trends (Figure 1). Stable water level trends reflect ample recharge for current withdrawals.

The influence of surface-water recharge is seen in ground water chemistry observed in shallow alluvial aquifers and underlying semi-confined zones (Hutchings and Petrich, 2002). Ground water underlying shallow alluvial aquifers in eastern portions of the valley near the Boise River typically has shorter ground water residence times and lower total dissolved (TDS) values than areas to the west.

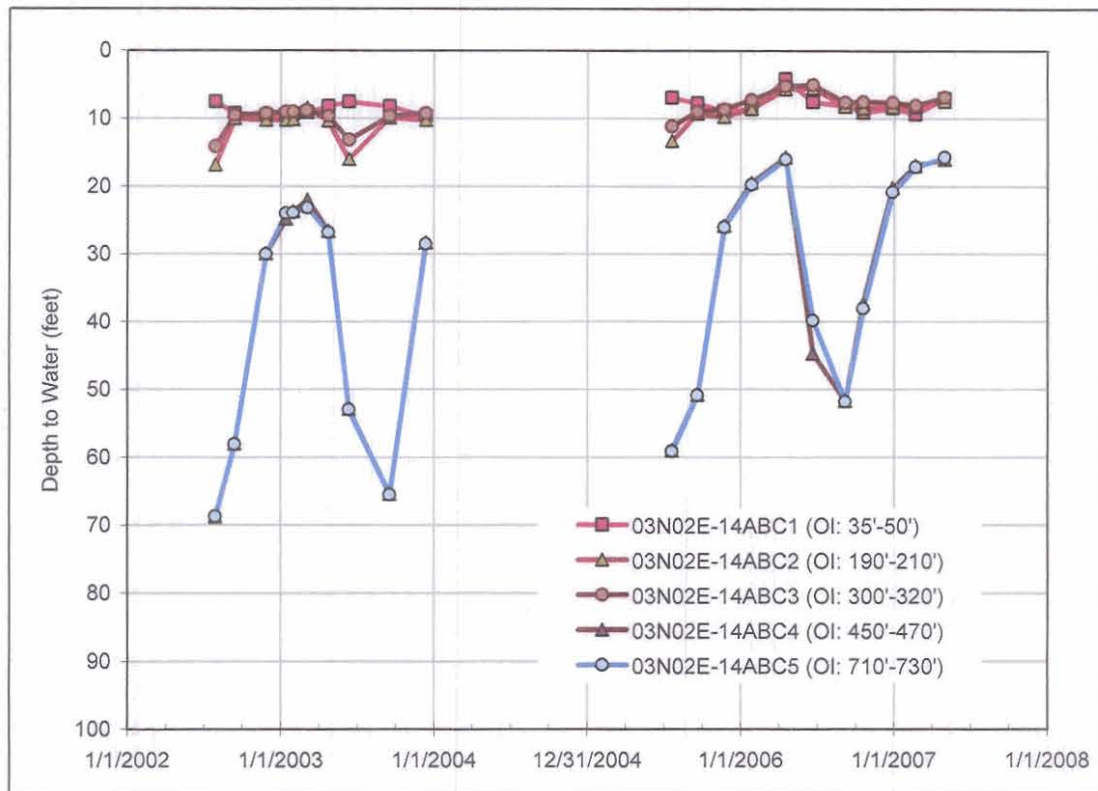


Figure 1: Water levels in the Municipal Park piezometer nest.

Ground water withdrawals from BSU area will result in depletion of Boise River flows. Ground water withdrawals from shallow- or intermediate-depth aquifers in the Boise River corridor will lead to induced recharge from, and/or decreased discharge to, the Boise River or shallow alluvial aquifers (Petrich, 2004a; Petrich, 2004b). However, diversion of water from the semi-confined aquifer zone in the BSU area is not anticipated to have a negative impact on flows in the Boise River or local ground-water levels for the following reasons:

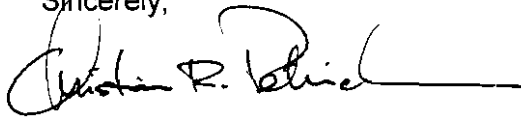
1. The use of water is entirely non-consumptive, and the water is discharged to the Boise River. As a result, the diversion of ground water for cooling use will not deplete river flows.
2. Pumping of ground water from cooling wells at BSU has been an ongoing activity since the 1960s (see attached report by Keith Anderson dated August, 1967). At that time, there were actually three wells in use for this purpose. As a result, any impact to ground-water levels related to this on-going water use was established decades ago. Therefore, approval of the proposed permit will not result in any new impact to ground-water levels.

Stream Channel Alteration Permit Not Required

The well in question is referred to as the "Liberal Arts" well in BSU's records and we include a "Report of Well Driller" from the University archives confirming the well was drilled in 1966 for "air conditioning". The cooling system was developed at that time, including the construction of the discharge structure to the Boise River. The statute requiring a stream channel alteration permit (§42-3801, Idaho Code) was enacted in 1971, several years after the discharge to the Boise River began. It is our understanding a stream channel alteration permit is not required in this case.

Please contact us with any questions or if you need additional information.

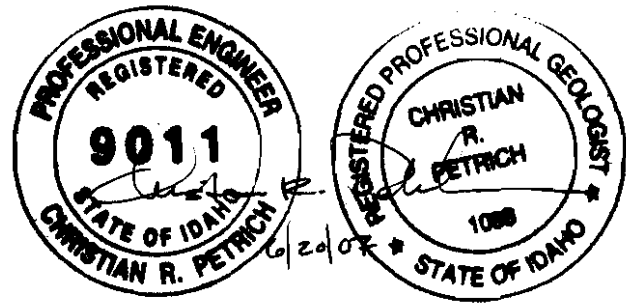
Sincerely,



Christian R. Petrich, Ph.D., P.E., P.G.
Principle Engineer/Hydrologist



Roxanne Brown
Water Right Specialist



Attachments:

- Driller's report for the Boise College – Liberal Arts Well
- Well Interference Investigation Boise College, August 1967

Cc: Tim Fearnside - BSU

References

- Anderson, K.E., August, 1967. Well Interference Investigation - Boise College, Consulting report prepared for Wisdom, Sudweeks & White, Inc., Consulting Engineers, Boise - Pocatello, Idaho.
- Hutchings, J. and Petrich, C., 2002. Ground water recharge and flow in the regional Treasure Valley aquifer system - geochemistry and isotope study, Idaho Water Resources Research Institute, Research Report IWRRRI-2002-08.
- Petrich, C. and Urban, S., 2004. Characterization of Ground Water Flow in the Lower Boise River Basin, Idaho Water Resources Research Institute and the Idaho Department of Water Resources, Research Report IWRRRI-2004-01.
- Petrich, C.R., 2004a. Simulation of Ground Water Flow in the Lower Boise River Basin, Idaho Water Resources Research Institute, Research Report IWRRRI-2004-02.
- Petrich, C.R., 2004b. Simulation of Increased Ground Water Withdrawals in the Treasure Valley Associated with Unprocessed Well Applications, Idaho Water Resources Research Institute, Research Report IWRRRI-2004-03.
- Wood, S.H. and Clemens, D.M., 2004. Geologic and tectonic history of the western Snake River Plain, Idaho and Oregon, Idaho Geologic Survey.

KEITH E. ANDERSON

ENGINEER - GEOLOGIST

606 IDAHO BLDG. - P. O. BOX 1411

BOISE, IDAHO 83701

WELL INTERFERENCE INVESTIGATION
BOISE COLLEGE

Prepared For
Wisdom, Sudweeks & White, Inc.
Consulting Engineers
Boise - Pocatello, Idaho



August 1967

ANDERSON & KELLY
CONSULTANTS IN ENGINEERING AND GEOLOGY
420 SIMPLOT BLDG. - P.O. BOX 1411
BOISE, IDAHO 83701

Wisdom, Sudweeks & White, Inc.
1108 Idaho Street
Boise, Idaho

Re: Boise College Well Interference

Gentlemen:

In accordance with your request we have investigated the problems related to the three wells at Boise College used for air conditioning. In addition to the basic data you supplied on well construction and discussions on well histories and performances, we obtained information from a pumping test on the Liberal Arts well. Well logs and construction data on the wells are attached.

Pumping Test

The Liberal Arts well was shutdown the evening of July 29th in order to allow for a recovery to an essentially static water level in the area. The Library and Student Union wells are not presently equipped with pumps so that the only influence of pumping in the area during the recovery period was outside the immediate College area. Inquiries were made regarding nearby wells and, since most wells are pumped continuously, no startups or shutdowns were made that would greatly influence the college well recovery.

The three wells in question were measured the morning of July 31st following which the Liberal Arts well was started. Periodic water level measurements were made in the Library and Student Union wells until the morning of August 1st, a period of 26 hours. Periodic recovery water level measurements were made during a four hour period on all three wells. It was not possible to measure water level or drawdown in the Liberal Arts well during the pumping period.

Test Results

During the period of measurement, it was evident that the Liberal Arts well has a pronounced effect on both the Library and Student Union wells. Interpretation of the data obtained indicates that all of these wells have relatively low water yielding capacities and that each well will exert considerable influence on the other two. In other words, the lowering of the water table during pumping (drawdown) in a particular well will also cause a drawdown of lesser magnitude in the other wells.

Calculations based on the data available indicate that pumping levels in the wells during simultaneous operation at designed capacities will be at much greater depths than present or planned pump settings. The following table illustrates the magnitude of drawdowns anticipated.

<u>Well</u>	Pumping Rate (GPM)	<u>Drawdown Caused By</u>			<u>Total Drawdown</u>
		<u>Liberal Arts Well</u>	<u>Library Well</u>	<u>Student Union Well</u>	
Liberal Arts	150	58'	34'	51'	143'
Library	150	17'	30'	22'	69'
Student Union	226	28'	28'	75'	131'

The present static or non-pumping water level in the area is about 30 feet so that the indicated pumping levels, in feet below ground level, would be:

Liberal Arts Well - 173 feet

Library Well - 99 feet

Student Union Well - 161 feet

Neglecting the fact that the estimated pumping level in the Liberal Arts well is equal to the depth of the well itself (173'), the physical limitations of pump and well casing sizes prohibit pump settings at these depths.

Well Construction

Construction of all three wells is such as to prevent simultaneous operation of all wells at designed capacities.

The well depths or straightness are inadequate to permit 6-inch pumps to be installed to the necessary depth.

It is not possible to obtain the desired quantity of water from any one well with a 4-inch pump, even operating at high speed (3600 rpm). Similarly it is not possible to obtain the desired quantity with a 6-inch pump except by having to install such a pump within the perforated 6-inch liner pipes. From a

hydraulic standpoint it is undesirable to utilize a 6-inch pump (about $5\frac{1}{2}$ inches outside diameter or larger) inside a 6-inch inside diameter casing unless essentially all of the water reaching the pump comes from lower in the well.

A more definite hazard exists, however, in placing a 6-inch pump inside perforated 6-inch pipe in that even a few particles of the gravel filter may enter the well above the pump and lodge in such a way as to securely bind the pump in the pipe and prevent future removal of the pump.

The Library well poses an added problem in that (1) the 6-inch liner is sufficiently crooked that a pump cannot be lowered below about 110 feet, and (2) the well is within a building with no access for drilling or pump servicing rigs.

Possible Solution

The previous table indicates that the Student Union well will have the greatest influence on the other two wells because of its higher design capacity of 226 gallons per minute. Consequently it seems that this well should be rehabilitated or replaced. This recommendation also is influenced by the fact that the Student Union well has not been pumped, is not presently used, and has an easier access than the other two. A re-calculation of anticipated drawdowns in the other two wells, without the interference of the Student Union well, shows that they can be expected to perform reasonably well at pump settings of

about 110 feet or less. The following table does not include the proposed "new" Student Union well influence because it would draw water from a different (deeper) zone and, consequently, have little or no effect on the other two wells.

<u>Well</u>	<u>Drawdown Caused By</u>		<u>Total Drawdown</u>
	<u>Liberal Arts Well</u>	<u>Library Well</u>	
Liberal Arts	58'	34'	82'
Library	17'	30'	47'

The indicated pumping levels, using a 30 foot static water level, would then be:

Liberal Arts Well - 112'

Library Well - 77'

Conclusions

The calculations of drawdowns caused by well interference presented herein represent an order of magnitude that is sufficiently accurate to conclude that it will be impossible to operate all three wells simultaneously at their designed pumping capacity. This is due to a number of reasons, of which the principal ones are: 1) limited saturated thickness of water bearing material, 2) low water-yielding capability of water bearing zone, and 3) well depths and diameters. Of course, a general lowering of the water table in the area during the summer contributes to the problem also.

Data from well logs at the College, as well as from other wells in the vicinity, supported by general hydrologic and geologic knowledge, indicate that more permeable water bearing zones occur at greater depths. The most practical solution

to the well interference problem is to deepen or re-drill the Student Union well.

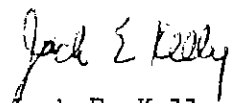
Recommendations.

1. It is recommended that the Student Union well be deepened or a new well drilled to a depth of about 250 feet. It may be advisable to utilize a different method of well completion, such as a well screen instead of perforated casing, but these details can be worked out later. The pump setting will depend on the results of test pumping of the new or deepened well. A cost estimate for alternates of deepening and a new well are attached.
2. The Liberal Arts well pump may have to be lowered to 120 - 130 feet but, for the time being, the setting can remain at the 110 foot level, pending observation of water levels after all three wells are in operation.
3. The Library well pump should be set at 100 feet. Apparently problems were encountered during an attempted setting at 110 - 120 feet but a 100-foot setting should be possible with either the existing pump or a new submersible pump.
4. The airline in all wells should extend to approximately the depth of the pump to allow observation and recording of pumping levels at the wells.
5. Water levels in the wells should be recorded regularly, at approximately one week intervals, after the recommended program has been completed and the wells are in operation.

We appreciate the cooperation of your office and the Building and Grounds Administration of Boise College during this study. We would be happy to assist in the implementation of the recommended program if this seems desirable.

Sincerely,

ANDERSON & KELLY


Jack E. Kelly

JEK/cr

cc: Hummel, Hummel, Jones & Shawver

Mr. Herbert Mengel, Director of Buildings and Grounds
Boise College

Approximate Costs For Deepening or Re-drilling

Student Union Well, Boise College

Deepen Existing Well (10-inch diameter From 170 to 250 Feet:

Remove 6-inch liner	\$250.
Extend 10-inch casing & hole to 170 ft.	900.
Drill and case 10-inch hole 170-250 ft.	800.
Furnish and install well screen	400.
Develop and test	<u>1,200.</u>
Estimated Total	\$3,550.

Drill New Well (12-inch diameter*) to 250 Feet:

Drill and case 12-inch hole to 250 ft.	\$3,000.
Furnish and install well screen	500.
Develop and test	<u>1,200.</u>
Estimated Total	\$4,700.

* If a new well is drilled, a 12-inch diameter is recommended to allow for possible gravel filter installation as well as possible future increased quantity of water required. If a new well were drilled with only 10-inch diameter to 250 feet, the total estimated cost would be \$4,100.

Reproduced from the University archives
In Boise State University Library

WELL LOG AND REPORT OF THE STATE RECLAMATION ENGINEER OF IDAHO

Permit No. _____ Well No. _____ County Idaho

Owner Boise Junior College - LIBRARY WELL

Address Boise, Idaho

Driller Russel Cowe

Address Boise, Idaho

Well location NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 15, T. 3N N/S, R. 2E E/W

Size of drilled hole 10"

Total depth of well 170'

Locate well in section

NW $\frac{1}{4}$	NE $\frac{1}{4}$ ⊗
SW $\frac{1}{4}$	SE $\frac{1}{4}$

Give depth to standing water from the ground 23 Water temp. _____ °Fahr.

On "Pumping Test" delivery was 250 g.p.m. or _____ c.f.s. Drawdown was 17 feet.

Size of pump and motor used to make test 6" turbine with 150 gas motor

Length of time of test 8 hours _____ minutes.

If flowing well, give flow _____ c.f.s. or _____ g.p.m. and of shut off pressure _____

If flowing well, described control works _____

(TYPE AND SIZE OF VALVE, ETC.)

Water will be used for air conditioning Weight of casing per lineal foot _____

Thickness of casing Schedule 40 Casing material steel

(STEEL, CONCRETE, WOOD, ETC.)

Diameter, length and location of casing _____

(CASING 12" IN DIAMETER OR LESS, GIVE INSIDE DIAMETER;
CASING OVER 12" IN DIAMETER, GIVE OUTSIDE DIAMETER)

CASING RECORD

Diam. Casing	From Feet	To Feet	Length	Remarks—seals, grouting, etc.
10"	0	70		blue clay
6"	65	85		
6"	85	155		perforated set on clay brown
	65	155		gravel packed

Number and size of perforations _____ located _____ feet to _____ feet from ground

In Boise State University Library

LIBRARY

WELL LOG

From Foot	To Foot	Type of Material	Water-bearing Formation Ans. Yes or No	Casing Perforated Ans. Yes or No
0	42	muddy gravel		
42	62	blue sand clay		
62	74	blue sticky clay		
74	77	blue sand some water		
77	105	blue clay		
105	153	blue sandstone or clay binder water		
153	165	brown clay		
165	170	coarse blue sand		
		pump well with 315 compressor 6 hours		
If more space is required use Sheet No. 2				

WELL DRILLER'S STATEMENT

This well was drilled under my supervision and the above information is complete, true and correct to the best of my knowledge and belief.

Reproduced from the University archives
In Boise State University Library

Signed

Russel Power

By

Dated Aug. 20, 1963, 19

License No. 65

REPORT OF WELL DRILLER
State of Idaho

State law requires that this report shall be filed with the State Reclamation Engineer within 30 days after completion or abandonment of the well.

WELL OWNER:
Name Boise College - LIBERAL ARTS

Address College Blvd., Boise, Idaho

Owner's Permit No. _____

NATURE OF WORK (check): Replacement well ☐
New well ☒ Deepened ☐ Abandoned ☐

Water is to be used for: air conditioning

METHOD OF CONSTRUCTION: Rotary ☐ Cable ☒
Dug ☐ Other _____ (explain)

CASING SCHEDULE: Threaded _____ Welded ☒

10 "Diam. from 0 ft. to 130 ft.

_____ "Diam. from _____ ft. to _____ ft.

_____ "Diam. from _____ ft. to _____ ft.

_____ "Diam. from _____ ft. to _____ ft.

Thickness of casing: _____ Material: _____

Steel ☒ concrete ☐ wood ☐ other ☐

(explain)
PERFORATED? Yes ☒ No ☐ Type of perforator used: _____

Size of perforations: 1/16 " by 6 "

_____ perforations from 173 ft. to 163 ft.

_____ perforations from _____ ft. to _____ ft.

_____ perforations from _____ ft. to _____ ft.

_____ perforations from _____ ft. to _____ ft.

WAS SCREEN INSTALLED? Yes ☐ No ☒

Manufacturer's name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

CONSTRUCTION: Well gravel packed? Yes ☒

No. ☐ size of gravel 3/4" agg. Gravel

placed from 160 ft. to 173 ft. Surface seal

provided? Yes ☐ No ☐ To what depth?

_____ ft. Material used in seal: hard shale

a hoe driven right into shale making seal.

Did any strata contain unusable water? Yes ☐

No. ☐ Type of water: _____

Depth of strata _____ ft. Method of sealing

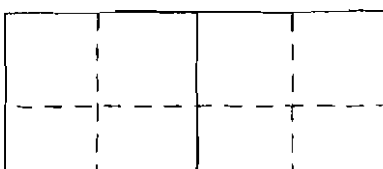
strata off: cased with clay seal on bottom

Set drive shoe in blue clay (shale)

Surface casing used? Yes ☐ No ☒

Cemented in place? Yes ☐ No ☒

Locate well in section



Size of drilled hole: 10" Total
depth of well: 173' Standing water
level below ground: 20' Temp.
Fahr. 55 ° Test delivery: 250 gpm
or _____ cfs Pump? ☐ Bail ☐

Size of pump and motor used to make test:
air compressor

Length of time of test: 6 Hrs. Min.

Drawdown: 31 ft. Artesian pressure: ft.

above land surface _____ Give flow _____ cfs

or _____ gpm. Shutoff pressure: _____

Controlled by: Valve ☐ Cap ☐ Plug ☐

No control ☐ Does well leak around casing?

Yes ☐ No ☒

DEPTH MATERIAL WATER

FROM TO YES OR NO

FEET FEET

0 3 top soil no

3 33 gravel and boulders no

33 90 muddy sand ye

90 135 blue clay no

135 170 gray sandy shale no

170 172 coarse sand bottom ye

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

Work started: 6-25-66

Work finished: 7-27-66

Well Driller's Statement: This well was

WELL LOG AND REPORT TO THE STATE RECLAMATION ENGINEER OF IDAHO

STATIC LEVEL 7-26-67 44'-5"
SUBMIT WITHIN 30 DAYS AFTER COMPLETION OF WELL: SEE IDAHO STATUTES 42-238

Permit No. Boise College Well No. _____ County _____

Owner Boise, Idaho Student Union

Address _____

Driller Russel Cowe

Address Boise Idaho

Well location _____ $\frac{1}{4}$ _____ $\frac{1}{4}$ Sec. _____, T. _____ N/S, R. _____ E/W

Size of drilled hole 10"

Total depth of well 170 ft

Give depth to standing water from the ground 23 Water temp. 56 °Fahr.

Test delivery was 200 g.p.m. or _____ c.f.s. Drawdown was 57 feet. Pump? ☒ Bail? ☐

Size of pump and motor used to make test 6" turbine

Length of time of test 8 hours _____ minutes.

If flowing well, give flow _____ c.f.s. or _____ g.p.m. and of shut off pressure _____

If flowing well, described control works _____

(TYPE AND SIZE OF VALVE, ETC.)

Water will be used for cooling Weight of casing per lineal foot standard

Thickness of casing 5/16 Casing material steel
(STEEL, CONCRETE, WOOD, ETC.)

Diameter, length and location of casing _____

(CASING 12" IN DIAMETER OR LESS, GIVE INSIDE DIAMETER;
CASING OVER 12" IN DIAMETER, GIVE OUTSIDE DIAMETER)

Reproduced from the University archives

In Boise State University Library

CASING RECORD

Diam. Casing	From Feet	To Feet	Length	Remarks—seals, grouting, etc.
10"	0	99		10" hole drilled to 170 ft
6"	87	170		6" perforated pipe placed in hole with $\frac{3}{8}$ " gravel extending up to 86 ft level.

Number and size of perforations $\frac{1}{8}$ by 3 located 108 feet to 170 feet from groun
between 500 x 600

STUDENT UNION

WELL LOG

[illegible]

Reproduced from the University archives

In Boise State University Library

This well was drilled under my supervision and the above information is complete, true and correct to the best of my knowledge and belief.

Signed _____

By _____

License No. _____

Dated May 22, 1967.

Well Driller's Helper_____

State law requires that this report shall be filed with the State Reclamation Engineer within 30 days after completion or abandonment of the well.

WELL OWNER:
Name Boise College - LIBERAL ARTS

Address College Blvd., Boise, Idaho

Owner's Permit No. _____

NATURE OF WORK (check): Replacement well ☐
New well ☒ Deepened ☐ Abandoned ☐

Water is to be used for: air conditioning

METHOD OF CONSTRUCTION: Rotary ☐ Cable ☒
Aug ☐ Other _____

(explain)

CASING SCHEDULE: Threaded _____ Welded ☒
10 "Diam. from 0 ft. to 130 ft.
"Diam. from _____ ft. to _____ ft.
"Diam. from _____ ft. to _____ ft.
"Diam. from _____ ft. to _____ ft.

Thickness of casing: _____ Material: _____

Steel ☒ concrete ☐ wood ☐ other ☐

(explain)

PERFORATED? Yes ☒ No ☐ Type of perforator used: _____

Size of perforations: 1/16 " by 6 "
perforations from 173 ft. to 163 ft.
perforations from _____ ft. to _____ ft.
perforations from _____ ft. to _____ ft.
perforations from _____ ft. to _____ ft.

WAS SCREEN INSTALLED? Yes ☐ No ☐

Manufacturer's name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

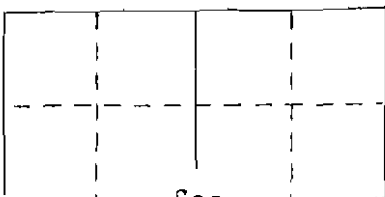
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

CONSTRUCTION: Well gravel packed? Yes ☒
No. ☐ size of gravel 3/4" agg. Gravel placed from 160 ft. to 173 ft. Surface seal provided? Yes ☐ No ☐ To what depth? _____ ft. Material used in seal: hard shale

a hoe driven right into shale making seal.
Did any strata contain unusable water? Yes ☐
No. ☐ Type of water: _____
Depth of strata _____ ft. Method of sealing strata off: cased with clay seal on bottom
Set drive shoe in blue clay (shale)

Surface casing used? Yes ☐ No. ☐
Cemented in place? Yes ☐ No ☒

Locate well in section



Size of drilled hole: 10" Total depth of well: 179' Standing water level below ground: 76' Temp. Fahr. 55 ° Test delivery: 250 gpm or _____ cfs Pump? ☐ Bail ☐
Size of pump and motor used to make test: _____

air compressor

Length of time of test: 6 Hrs. Min.
Drawdown: 31 ft. Artesian pressure: ft. above land surface _____ Give flow _____ cfs or _____ gpm. Shutoff pressure: _____

Controlled by: Valve ☐ Cap ☐ Plug ☐
No control ☐ Does well leak around casing? Yes ☐ No ☒

Yes ☐ No ☒

DEPTH		MATERIAL	WATER
FROM	TO		YES OR NO
FEET	FEET		
0	3	top soil	no
3	33	gravel and boulders	no
33	90	muddy sand	ye
90	135	blue clay	no
135	170	gray sandy shale	no
170	172	coarse sand bottom	ye

Liner dropped down 5' during development. Water seems to be between two layers of shale. Blew out pocket at bottom and filled it with coarse gravel. Dropped small gravel around it. Coarse gravel gives liner foundation to set on.

Reproduced from the University archives
In Boise State University Library

Work started: 6-25-66
Work finished: 7-27-66
Well Driller's Statement: This well was drilled under my supervision and this report