

Nelson, Dan

From: Edl, Michele
Sent: Tuesday, February 23, 2021 4:40 PM
To: Nelson, Dan
Cc: Parker, Cody
Subject: FW: status request 65-23311 (IPCo in McCall)
Attachments: Heat_Pump_Runtime_Long_Valley_Ops_Center_Final.docx

Dan,
I got the promised document from my meeting with David Blew (IPCo) and Kevin Boggs (Jacobs Engineering Group) this afternoon.
This is basically a modeling effort rather than a measurement effort, so I am going to need some time to review it and fit it to our need for a volume. Maybe I'll be able to get to it by Friday.
I hope that timeline works for you.
Michele

From: Boggs, Kevin/BOI [mailto:Kevin.Boggs@jacobs.com]
Sent: Tuesday, February 23, 2021 3:10 PM
To: Edl, Michele <Michele.Edl@idwr.idaho.gov>
Cc: Blew, David <DBlew@Idahopower.com>
Subject: RE: status request 65-23311 (IPCo in McCall)

Good afternoon Michele,

Here's the memo we discussed last week (please see attached). This memo details the calculations for the heating/cooling volume for 65-23311.

Please reach out any time with any questions.

Thanks,
Kevin

208-340-1753

From: Edl, Michele <Michele.Edl@idwr.idaho.gov>
Sent: Friday, February 12, 2021 4:52 PM
To: Boggs, Kevin/BOI <Kevin.Boggs@jacobs.com>
Subject: [EXTERNAL] RE: status request 65-23311 (IPCo in McCall)

This is very good news, Kevin
My Wednesday is pretty booked. Thursday morning would be ok and I'm available all day Friday.
Are you thinking an online meeting or an in-person meeting?
Who will be the host?

IDWR's 5th floor has one conference room available all day on Friday. It would be limited to ~5 folks to keep us 6 feet distant but manageable with a headcount of 3 or 4 besides me. I'd be happy to reserve it.

My desktop pc doesn't have a camera, so a zoom meeting from my cube would be pretty bland. The department has zoom capability I haven't needed to use yet.

Michele
208-287-4946

From: Boggs, Kevin/BOI [<mailto:Kevin.Boggs@jacobs.com>]
Sent: Friday, February 12, 2021 4:36 PM
To: Edl, Michele <Michele.Edl@idwr.idaho.gov>
Subject: RE: status request 65-23311 (IPCo in McCall)

Hi Michele,

Thanks for reaching out. Idaho Power gave me the go ahead to set up a call with you late next week, perhaps sometime on Wed, Thursday, or Friday. They've been working on gathering information and they would like to share what they've developed. Is there an ideal time for you to meet with Idaho Power and me?

Thanks,
Kevin

From: Edl, Michele <Michele.Edl@idwr.idaho.gov>
Sent: Thursday, February 11, 2021 3:32 PM
To: Boggs, Kevin/BOI <Kevin.Boggs@jacobs.com>
Subject: [EXTERNAL] status request 65-23311 (IPCo in McCall)

Kevin,
Can you give me an update on your efforts to 'prove up' permit 65-23311?
Thanks
Michele

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Idaho Power Long Valley Operations Center
Heat Pump/Air Conditioning Water Use Estimates
2-22-2021
D. Blew – Idaho Power

Problem:

Idaho Power holds water right 65-23311 for a variety of purposes at the Long Valley Operations Center in Lake Fork, Idaho. A portion of that water right is for heating and cooling at the facility. The heating and cooling system includes an open loop water source heat pump. Water is pumped from a production well, used in the heat exchanger and then discharged into an onsite injection well. No water meters are installed on the heat pump so an estimate must be made for the annual water use for heating and cooling in order to complete the proof of beneficial use for water right 65-23311.

Methods and Procedure

This approach uses the electrical energy use (kWh) to calculate the run time associated with heating and cooling the Long Valley Operations Center. Hourly energy usage data (kWh) was secured through the Idaho Power Company records for the Long Valley Operations Center¹. Data was available for January 1, 2016 through December 31, 2020. The data was reviewed to determine if changes in energy use may signal the electrical draw by both the heat pump and the ground water well pump. These signals were observable in the raw data and a series of algorithms were developed to extract heating and cooling energy usage.

An examination of the energy usage showed several patterns both in the hourly time step, daily usage, weekly usage, and there is large seasonal variation. Hourly patterns show large changes in electrical draw, indicating activation of the heat pump and associated equipment. Daily patterns included increases in overall energy consumption in the mornings and in some cases additional increases in energy usage through the night, particularly if temperatures are below 0°F. Weekly signals showed a general decrease in energy consumption on the weekends. This may be due to the use of a “smart” thermostat to program and control temperatures differently on the weekends. Seasonal signals included a dramatic decline in overall electrical use in the spring and summer months.

The modeling presented here assumes that heating and cooling can account for approximately 40% of the electrical load during an hourly timestep. The methodology targets the 40% between the 45% to 5% exceedance of kWh for each hourly time step (Equation 1 and Equation 2). There are instances of higher than normal energy usage that could be due to the operation of other equipment on site. The use of the 45% to 5% exceedance is to account for any excess energy demands not associated with heating and cooling. Two primary equations were used to develop an estimate of annual runtime of the heating and cooling system.

Equation #1

Hourly kWh – 45% exceedance for a 48-hour period around the timestep = Difference in kWh

This equation establishes the difference in energy usage for each hourly timestep from a determined level of base energy consumption based on the 45% exceedance for a 48-hour period (24 hours before and after the timestep).

¹ Raw energy usage data is considered customer data and as such is classified as confidential and cannot be shared.

Equation #2

Difference in kWh / The 5% exceedance for all timesteps calculated in Equation #1 = Runtime (kWh)

This equation establishes a standard to convert kWh to an estimated runtime of the heat and cooling system. The equation assumes that the 5% exceedance for energy differential, for all time steps, as determined by equation #1, represents one hour of heating or cooling at 80 gpm². Each time step is then evaluated as a percentage of this standard. For example, if the kWh for an hourly timestep is 50% of the calculated 5% exceedance, the modeling assumes this represents the heating and cooling system running for one-half hour at 80 gpm (it could also be interpreted that the system is running at 40 gpm for an entire hour).

The hourly runtimes are aggregated and converted to gpm and then acre-feet for each month. Yearly totals are then calculated for each of the five years in the data set.

Calculation of Water Use for 2016 - 2020

Musgrove Engineering developed a set of design documents for the Long Valley Operations Center. This design information included an analysis of all energy uses and other potential sources of heat and cooling in the facility. This analysis allowed for an initial estimate of energy consumption for heating and cooling and an initial estimate of water use. Figure 1 shows energy consumption comparison

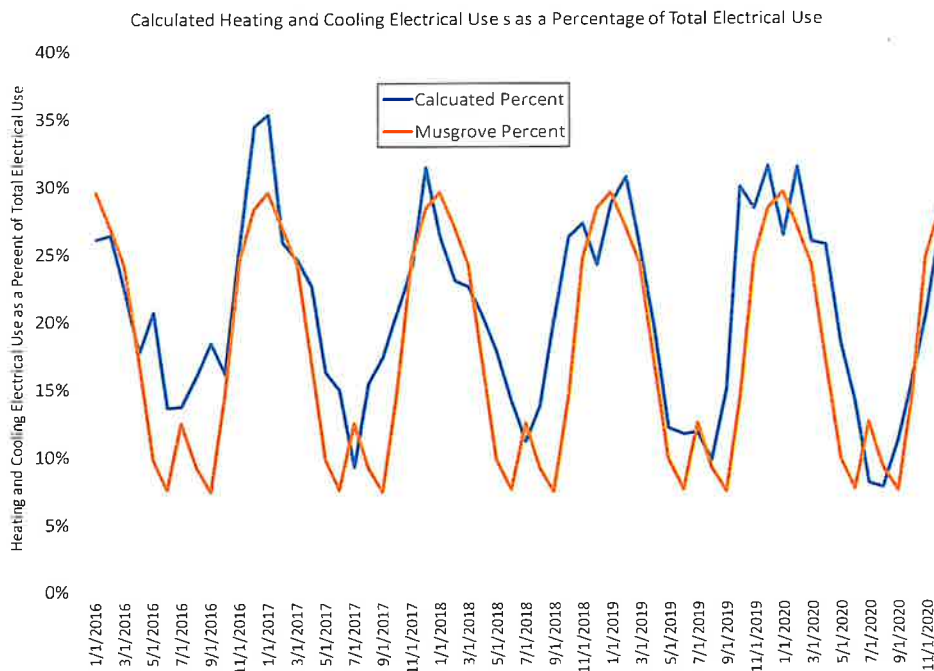


Figure 1: Comparison of energy use of the heating/cooling system as a percent of total energy use.

between the Musgrove Engineering calculations, and the calculations described in this paper. Figure 1 shows the electrical use for heating and cooling as a percentage of total electrical use.

The data in Figure 1 shows generally good agreement between the estimates made by Musgrove Engineering and

the methodology described in this paper. The Musgrove calculations are only one modeled year that is repeated for five years in the graph for comparison purposes. Musgrove calculations show the peak

² The system design documents show the system designed for 80 gpm withdrawal of ground water to operate the the heating and cooling system.

heating demand to be approximately 30% of the total electrical demand. Based on equations #1 and #2 using actual energy data, peak heating demand is between 30% and 35% of the total electrical demand.

Figure 2 shows a comparison of the Jacobs Engineering estimates, based on the Musgrove Engineering data, for total monthly runtime. The figure also shows the runtime calculated using the methodology described in this paper. Both estimates show a similar runtime for winter months, however, the runtimes for the summer are higher in the estimates based on actual energy data. While differences do exist, the two estimates show similarities in pattern and total monthly use.

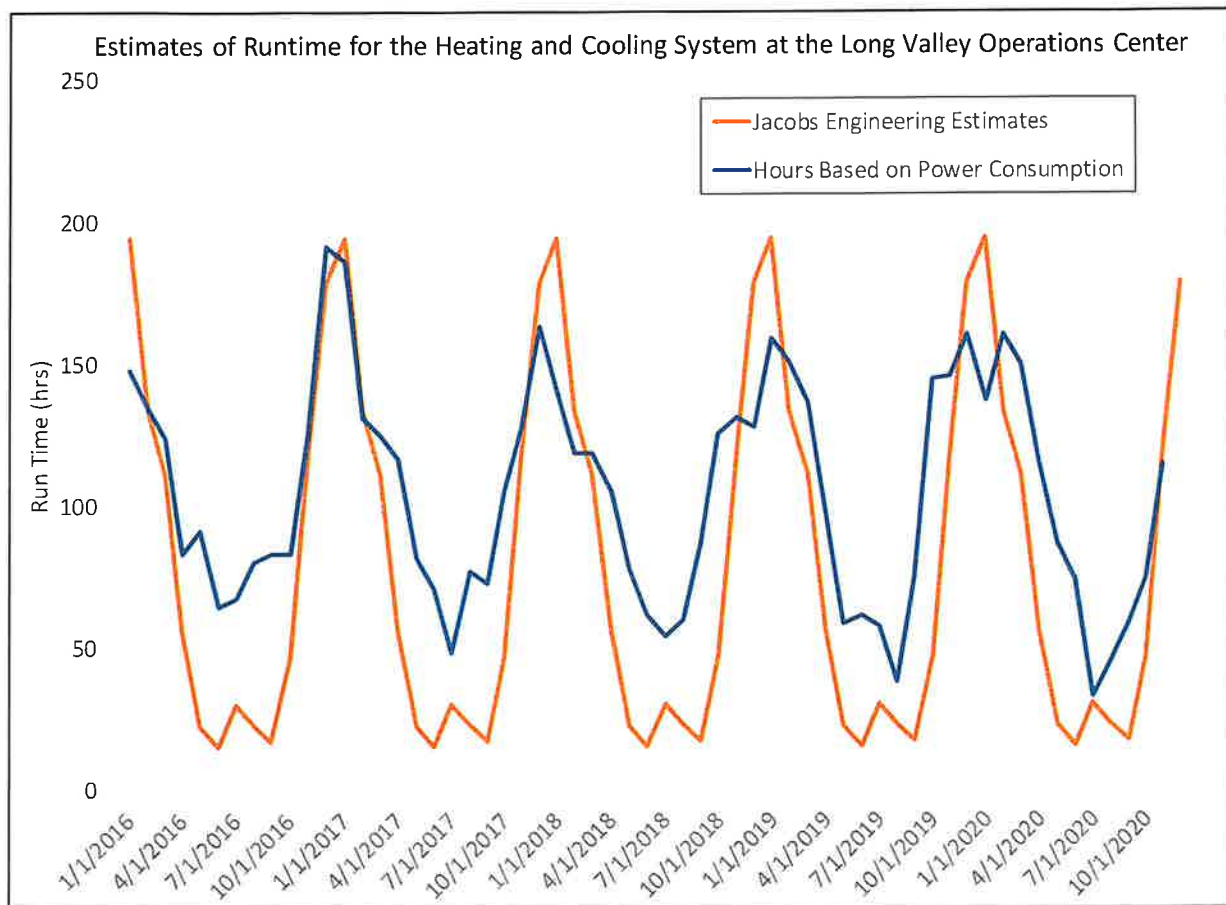


Figure 2: Estimates of runtime of the heating and cooling system at the Long Valley Operations Center.

The methodology described in this paper to calculate energy use and runtime of the heating and cooling system at the Long Valley Operations Center is consistent with the estimates provided by Jacobs Engineering. The biggest difference appears to occur in the spring and summer months. However, as shown in Figure 1 the calculated percent of total electrical use is not vastly different between the two methodologies.

Jacobs Engineering made an original estimate of water use by the heating and cooling system at the operations center. Those estimates were based on design data developed by Musgrove Engineering. Jacobs Engineering estimates for annual water use were approximately 14 acre-feet. The data shown in Figure 2 show a significant difference in the two calculations for the runtime of the heating and cooling in the spring and summer months. This increases the total calculated water use in the methodology

described in this paper. Table 1 shows the calculated water use for heating and cooling at the operations center. While these numbers are higher than those calculated by Jacobs Engineering, they may reflect seasonal variation, or heating and cooling requirements not foreseen or contemplated in the original design documentation.

Table 1: Estimate of water use for heating and cooling at the Long Valley Operations Center for calendar years 2016 – 2020.

Year	Acft
2016	18.8
2017	19.2
2018	17.8
2019	18.9
2020	17.3

Projection of Maximum Water Demand

Figure 3 shows the correlation between temperature and calculated water use at the Long Valley Operations Center. A simple linear regression was used for the analysis. While in some cases, a polynomial may be more appropriate if high summer temperatures drive water use higher than the spring and fall. However, in this scenario it is apparent that cooling requirements in the summer do not exceed heating requirements in the spring and fall months. The figure shows a reasonable relationship between temperature and water use at the facility. Temperature used in the analysis is from the McCall, Idaho airport.

To calculate a maximum water use scenario, monthly average temperature for the period of 1970 – 2020 for the City of McCall was downloaded. Using the regression formula from Figure 3 ($y = -0.0333 * T + 2.9272$), water use for both the minimum and maximum monthly average temperatures were used to calculate monthly water use. Table 2 shows the calculated monthly water use for heating and cooling at the operations center. The minimum monthly average temperature provides the highest calculated yearly water use. The maximum temperatures in the summer months show lower water use than those of the minimum. This may be an indication that cool summer temperatures may drive higher water use and may be the reason for the deviation of the summer calculated water use between the Jacobs engineering numbers and those calculated for this report. Based on the calculations completed for this analysis, the maximum projected water use for the heating and cooling system at the Idaho Power Long Valley Operations Center is 21.7 acre-feet.

Comparison of Monthly Average Temperature in McCall, Idaho and Projected Water Use for Heating and Cooling at the Idaho Power Long Valley Operations Center
For the Period of 2016 - 2020

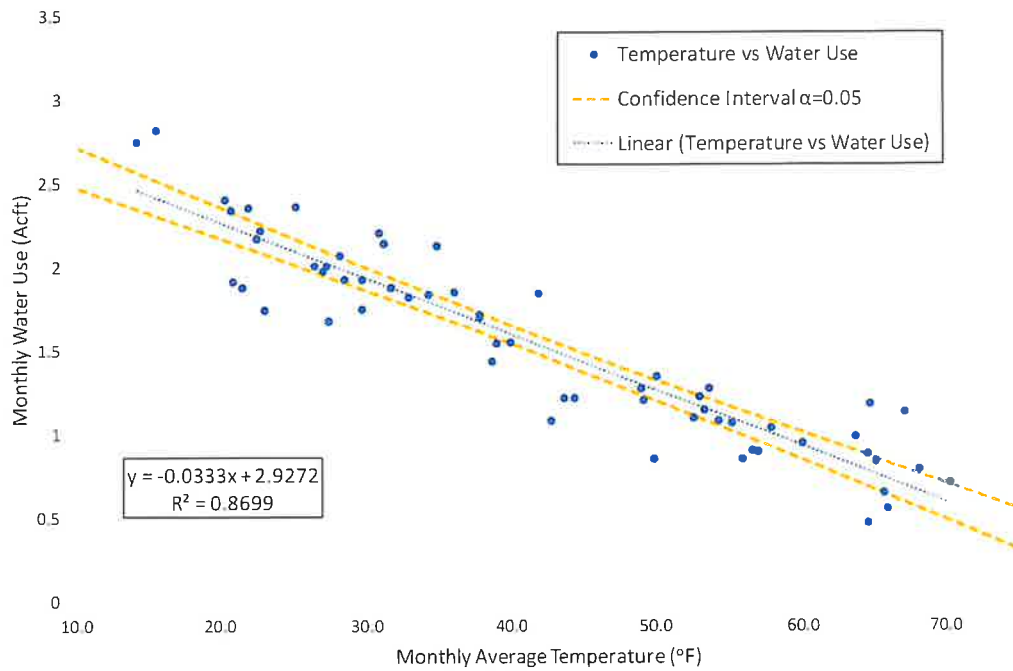


Figure 3: Correlation between monthly average temperature and calculated water use

Table 2: Calculated water use based on the monthly average minimum and maximum temperatures in McCall, Idaho.

	Monthly Minimum Average	Year of Minimum	Calculated Acft Based on Minmum Ave	Monthly Maximum Average	Year of Maximum	Calculated Acft Based on Maximum
Month	Temperature (°F)	Temp	Temp	Temperature (°F)	Temp	Ave Temp
Jan	11.0	1979	2.6	28.5	2018	2.0
Feb	18.5	1985	2.3	34.1	2015	1.8
Mar	24.7	1976	2.1	41.8	1985	1.5
Apr	31.4	1975	1.9	47.2	1992	1.4
May	41.7	2010	1.5	54.7	1992	1.1
Jun	51.2	1975	1.2	62.8	2015	0.8
Jul	53.2	1993	1.2	69.5	2007	0.6
Aug	55.2	1983	1.1	65.3	2017	0.8
Sep	45.3	1986	1.4	58.6	1998	1.0
Oct	36.3	2019	1.7	48.9	2015	1.3
Nov	23.3	2000	2.2	42.1	1995	1.5
Dec	11.7	1990	2.5	29.0	1995	2.0
Total Acft			21.7			15.7

Nelson, Dan

From: Nelson, Dan
Sent: Thursday, January 07, 2021 11:00 AM
To: 'Boggs, Kevin/BOL'
Cc: Edl, Michele
Subject: RE: Field Report for Permit 65-23311
Attachments: 01 theoretical sheet Craigs.xls

Hello Kevin,

As I stated earlier, Michele Eld is going to review your heating calculations.

I went over your flow rate calculations, and I am still confused. Based on my calculations shown in the attached spreadsheet. Under the best of conditions, this pump can operate at a maximum capacity of 150 gpm to 171 gpm. The pump curve you supplied states that the pump is rated to operate at 150 gpm. You confirmed that the pumping water level on the pump is 127 feet, but I still don't know the system operating pressure. I estimated 50 psi, but I don't have confirmation of that pressure.

Here is where I am confused. When you add all of the recommended diversion rates together they come up to the following:

Irrigation 65-23851 = 0.066 cfs or 29.6 gpm

Irrigation 65-23311 = 0.012 cfs or 5.4gpm

Heating and cooling 65-23311 Water to Water supply and injection system = 0.178 cfs or 80 gpm

Heating and cooling 65-23311 HP 1-7 Heat Pumps = 0.20 cfs or 90 gpm

Domestic 65-23311 = 0.10695 cfs or 48 gpm

The total diversion rate need just to operate the heating and cooling system is 170 gpm (80 gpm + 90 gpm). If you then add in the domestic and irrigation system the total diversion rate needed would be an additional 83 gpm (29.6 gpm + 5.4 gpm + 48 gpm = 83 gpm) for a total needed capacity of 253 gpm or 0.56 cfs. How can a well pump rated at 150 gpm provide 170 gpm let alone 253 gpm if needed? The numbers are not matching between the flow rate required and the pump capacity. In you field report, you listed the total heating and cooling diversion rate at 0.21 cfs or 94 gpm, which doesn't match the 170 gpm you state is the flow rate requirements for the heating and cooling system.

You asked us to look at the diagram for the heating system, but I didn't see a diagram of the system. I did see your tables, which I gave to Michele, but I can't see anything that resembles a diagram of the heating system.

I wanted to get my portion of the review to you as soon as I could. I am sorry about my confusion on this system, but it doesn't make sense that they would try to operate a system of this size with all the different uses with a well that can't provide for all their needs or the at least above the heating requirements.

Dan Nelson

Nelson, Dan

From: Nelson, Dan
Sent: Wednesday, January 06, 2021 3:06 PM
To: 'Boggs, Kevin/BOI'
Subject: RE: Field Report for Permit 65-23311

Hello Kevin,

I turned over your calculations for heating and cooling over to our heating and cooling specialist Michele Eld. She may be contacting you if she has any questions on your calculations. I wanted to let you know so you weren't confused in dealing with multiple folks. She knows more about the heating and cooling side of things than I do, so it is best if she reviews your work.

Dan Nelson

From: Boggs, Kevin/BOI [mailto:Kevin.Boggs@jacobs.com]
Sent: Tuesday, January 05, 2021 1:19 PM
To: Nelson, Dan <Dan.Nelson@idwr.idaho.gov>
Cc: Blew, David <DBlew@Idahopower.com>
Subject: RE: Field Report for Permit 65-23311

Good afternoon Dan,

Here is our response to your request for more information (please see the red italic font below and the supporting file attached).

Thanks again for coordinating on this one!

Kevin

208-340-1753

From: Nelson, Dan <Dan.Nelson@idwr.idaho.gov>
Sent: Tuesday, October 27, 2020 2:56 PM
To: Boggs, Kevin/BOI <Kevin.Boggs@jacobs.com>
Subject: [EXTERNAL] Field Report for Permit 65-23311

Dear Mr. Boggs;

I have review the field report you submitted for permit 65-23131. You recommended 0.11 cfs and 0.6 af for domestic use, 0.21 cfs and 76 af for both heating and cooling, and 0.01 cfs and 1.2 af for irrigation of 0.4 acres for a total of 0.33 cfs and 153.8 af. There were several issues that I needed to have clarified in this field report. I have listed each subject below and included attachments to this email to assist in my review.

You also submitted a field report for water right permit 65-23851 at the same time for this facility. Water right permit 65-23851 provides additional irrigation use for this property from the same well and water system. I will

hold processing of this permit until the issues are resolved with permit 65-3311, since they utilize the same well and water system.

Point of Diversion Place of Use:

I don't have any issues with the points of diversion and places of use you recommended.

Diversion Rate:

The Pump Capacity:

You were not able to measure the well due to the pipe size and configuration of the piping system. After reviewing your photos, I agree that a measurement isn't possible for this system. You did provide a well driller's report for the system, and the pump curves for the system. You didn't provide any system pressure or the pumping water level of the system. I was able to estimate the pumping water level using the well driller's report, but it was a little vague as to actual pumping water level. The well driller's report states the static level of the well is 47 feet, and the drawdown at 150 gpm was 127 feet. When you add the drawdown to the static level, the pumping water level according to the well driller's report would be 174 feet ($127 + 47 = 174$ feet). The total well depth is 175 feet, so it does seem from the well driller's report that the well is pumped dry when diverted at 150 gpm for 3 hours.

Taking this information into account, I performed several theoretical calculations, and I do believe the drawdown was actually the pumping water level.

Thanks for the comment here pointing out the issue on the well driller's report. We believe the well driller entered 127 feet in the column labelled "drawdown" when in fact the 127 feet was the pumping water level, not drawdown.

Taking this information, I performed several calculations. Please see my attached calculation sheet for my calculations. I believe that this system can produce the 150 gpm suggested in the pump curve data from this well.

Domestic Use:

You recommended a diversion rate for domestic use at 0.11 cfs, which was what was permitted. You stated that there are 2 toilets, 2 bathroom sinks, a kitchen fixture, an ice maker, and 4 outside and shop hose spigots. According to the Rural and Domestic Water Use sheet in the Field Examiner's Handbook, a toilet would require approximately 4-5 gpm, the lavatory sinks would require 1-4 gpm, and the kitchen sink would require 2-5 gpm. You stated that the outside spigots flowed at 3 gpm each, but I used the maximum of 5 gpm for the kitchen sink. I estimated the flow rate at $(5 \text{ gpm/toilet} \times 2) + (4 \text{ gpm/lavatory sink} \times 2) + 5 \text{ gpm kitchen sink} + 5 \text{ gpm ice maker} + (4 \text{ outside spigots} \times 5 \text{ gpm/spigot}) = 48 \text{ gpm}$. I then divided the 48 gpm by 448.8 and came up with 0.10695 cfs, which I rounded to 0.11 cfs.

I can agree with your recommendation of a diversion rate of 0.11 cfs for the domestic use, even though I used a different system for calculating the diversion rate for the domestic system than you did.

Thank you for providing these details and for the calculations.

Heating and Cooling:

You discussed the heating system. You state in the field report that there are 7 heating units. The first heating unit is a water to water unit, and the other 6 units are air to water units. There is very limited information on these units.

Generally, water to water units gather heat from a water source that runs water to a heat exchanger and then is run back to the injection well (*correct, we agree*). The heat drawn from the heat exchanger then exchanges the heat value gathered from the source water to the water in the closed loop system that sends heated water throughout the heating system. The water in the closed loop system is never replaced, so the only water that can be considered as part of the diversion rate would be the flow rate of the source water being delivered to the heat exchanger from the well and back out to the injection well. You stated that the source water delivered to this system runs at 35 gpm or 0.08 cfs. The other 6 units are described as air to water systems. Our understanding of air to water systems are very similar to the water to water systems, except that they gather heat from an air source and not a water source. Therefore, the only flowing water would be in the closed loop system, which would not need a constant flow of water from the well. There would be no flow rate associated with these units (*this is incorrect; please see the clarification below*).

I can only recommend a diversion rate of 0.08 cfs for the heating and cooling systems, unless you can supply some additional information that shows additional flow is needed. This can come from design documents and system diagrams that show how the system operates.

- The system is equipped with a supply/injection well loop and a hydronic heating/cooling closed loop (see flow diagram attached – IPC_LongValleyFacility_FlowDiagram.pdf). The water flowing through the closed loop is designed to flow at 90 gpm, and is the same water all the time (not replaced). The water in the supply/injection well loop is designed to flow at 80 gpm and is constantly replaced with water from the well; this water is re-injected into the ground.*
- The large heat pump (HP1) is a water to water heat pump and requires 35 gpm of water flow. The other 6 heat pumps (HP 2 through 7) each require 9 gpm (see attached file: HeatPump.pdf), a total of 54 gpm (see the attached file: IPC_LongValleyFacility_FlowDiagram.pdf)*

Irrigation:

I agree with your calculations for the irrigation use for the 0.4 acres of irrigation. The companion right of this permit, 65-23851, provides additional diversion rate, volume, and acres to the irrigation of this facility, so there shouldn't be any issues with limiting this irrigation rate to 0.01 cfs.

Diversion Volume:

System Capacity:

Based on the pump records, the system capacity would be 0.33 cfs (150 gpm) multiplied by 1.9835 and then multiplied by 365 days a year. This results in a total system capacity of 238.9 af rounded to 239 af.

Domestic Use:

You provided a very good analysis of the water use for the domestic portion of this permit except for the construction workers portion of the analysis. It is considered that construction workers use more water (50 gallons per shift), because they shower at the facility at least once per shift, or that there is a laundry service to clean their clothing. You state in this report that there are no laundry service or showers, so the only water use of the construction workers would only be the bathroom facilities. Therefore, the 9 construction workers should be limited to the same water use as the office workers of 15 gpd. This would reduce the employee use from 0.55 af to 0.229 af ($[15 \text{ employees} \times 15 \text{ gallons per shift} \times 333 \text{ shifts}] / 325850 = 0.229 \text{ af}$). When this is added to the shop use of 0.05 af, the total domestic volume should be limited to 0.279 af rounded to 0.3 af.

I can only recommend a domestic volume of 0.3 af as this stands currently. If you use the 5 gpm for the spigots that I used for the diversion rate calculations, the volume for the shop use would be 0.088 af ($[333 \text{ days} / 7 \text{ days/week}] \times 2 \text{ hrs} \times 60 \times 5 \text{ gpm} = 28,543 \text{ gpy} / 325850 = 0.0876 \text{ af}$). If you add that to the 0.229 af for

employee use, that would be 0.3 af rounded to 0.3 af for domestic use. Either way it is the same volume, but it remains consistent with the diversion rate calculations.

Thanks for this comment. We concur with this water use calculation approach related to construction and office workers.

Heating and Cooling:

In your analysis, you determined that this system ran non-stop all year long at a diversion rate of 0.21 cfs or 92 gpm, and determined the overall heating and cooling volume at 152 af. You then divided this volume equally as 76 af for heating and 76 af for cooling.

It is very unlikely that this system runs non-stop all year long. There is no discussion of heating degree days, cooling degree days, facility size, or the amount of heat load needed to maintain a preferred heat for this area and this facility. As discussed above, it appears as though this system only operates at a diversion rate of 35 gpm or 0.08 cfs, which would reduce the year round volume from the 152 af you calculate to 57.9 af ($0.08 \text{ cfs} \times 1.9835 \times 365 = 57.9 \text{ af}$) using your method.

It would be extremely inefficient for any heating and cooling system that ran non-stop all year long. It is also highly unlikely that this facility would use the same amount of water for cooling and it does for heating. Cooling generally requires between 5 to 20 % of the water used for heating. You should contact the engineer that installed the system and work with him to provide the water needed, or you could install a measurement device to monitor the water flow into the heating and cooling units for several days so we can extrapolate the annual water needs. We need a full analysis on how much water is needed to operate the heating portion of this system based on the inside design temperature, facility volume, heating degree days, and water needed to provide the heat load for this facility. A separate analysis using the same parameters needs to be done using the cooling degree days for the cooling use.

There is simply not enough information available in the field report to make a reasonably determination of the volume of water needed for the heating use or the cooling use. I recommend that you review the field reports for water rights 37-22542 and 37-22815 for information that may help him determine the volume for both the heating use and the cooling use.

Thank you for the opportunity to clarify the heating and cooling water demand and water use. We obtained the original design engineer's (Musgrove Engineering) heat gain/heat loss analysis (HVAC building load simulation). They provided the heat pump heat demand in kilowatt hours (KWh) for each month of the year, a number they developed using the number of heating degree days each month (see IPC_LongValleyFacility_HeatingCooling_WaterUseCalcs.xlsx). The following is an example heat pump run time calculation for January. Please see IPC_LongValleyFacility_HeatingCooling_WaterUseCalcs.xlsx for calculations for the entire year.

- 1. For January, the heat pump heat demand was 5056 KWh.**
- 2. Determine an appropriate Coefficient of Performance (COP) and quantify the amount of heat rejection at this COP.**
 - The COP is 4.7 @ 68 Deg F for heating*
 - The Energy Efficiency Ratio (EER) is 14.8 (BTU/Watt) @ 86 Deg F for cooling; a 4.3 COP cooling equivalent.*
 - Used a "combined" COP of 4.5. That is 4.5 watts output power/1.0 watt input power.*

$$5056 \text{ KWh} \times 4.5 [-] = 22,752 \text{ KWh}$$

3. Convert KWh to BTU, noting One BTU is the amount of heat required to raise the temperature of one pound of water by one degree F.

$$22,752 \text{ KWh} \times 3412 \text{ BTU hour}^{-1} \text{ KW}^{-1} = 77,628,135 \text{ BTU}$$

4. Convert BTU value to run time of the heat pump

- Per the engineering design drawings (IPC_LongValleyFacility_FlowDiagram.pdf), the Heat Exchanger is scheduled for a 10 degree F temperature delta at 80 gpm.
- Noting that heat = mass flow * specific heat capacity * temperature difference, where the mass flow rate [mass/time] is a measurement of the amount of water flowing around the hot water loop. The specific heat capacity, [energy/mass/temp] is a thermodynamic property specific of the fluid used to transfer heat, water in this case. The temperature difference [temp] is the difference in temperature before and after heat transfer, 10 °F in this case. Therefore,

$$(80 \text{ gal min}^{-1}) \times (1 \text{ BTU } ^\circ\text{F}^{-1} \text{ lbs}^{-1}) \times (10 \text{ } ^\circ\text{F}) \times (8.33 \text{ lbs gal}^{-1}) (60 \text{ min hour}^{-1}) = 399,840 \text{ BTU hour}^{-1}$$

can be used to convert BTUs calculated in step 3 to run time. That is,

$$77,628,135 \text{ BTU} \div 399,840 \text{ BTU hour}^{-1} = 194 \text{ hours of heat pump run time in January.}$$

This analysis applied to the entire year results in a total annual heating/cooling groundwater volume of approximately 4,524,200 gallons (13.9 acre-feet).

Irrigation:

You correctly determined the irrigation volume of 1.2 af.

The Idaho Beneficial Use Examination Rules 37.03.02.035.02.c states that we can give a certified water right examiner an additional 30 days to supply additional information to clarify the field exam report as stated below.

If the Director determines that a field report prepared by a certified water right examiner is acceptable but that additional information is needed to clarify the field report, he will notify the examiner in writing of the information required. If the additional information is not submitted within thirty (30) days or within the time specified in the written notice, the priority date of the permit will be advanced one (1) day for each day the information submittal is late. Failure to submit the required information within one (1) year of the date of the department's request is cause for the Director to take action to cancel the permit.

Therefore, please supply the above information by November 25, 2020. I can also give you additional time if you give a specific date that you can compile the needed information. If you have any questions, please don't hesitate to contact me.

Respectfully,

Daniel Nelson
Analyst 3
Idaho Department of Water Resources
Telephone (208) 287-4856
Fax (208) 287-6700 (attn: Dan Nelson)

Attachments: Theoretical Calculation Sheet

Rural and Domestic Water Uses Table

From: Nelson, Dan <Dan.Nelson@idwr.idaho.gov>
Sent: Monday, November 23, 2020 2:55 PM
To: Boggs, Kevin/BOI <Kevin.Boggs@jacobs.com>
Cc: Blew, David <DBlew@idahopower.com>
Subject: [EXTERNAL] RE: Field Report for Permit 65-23311

Dear Mr. Boggs;

Your request to extend the information required until January 11, 2021, has been granted. You will be required to supply the information in my earlier email on or before this date.

Thank you.

Daniel Nelson
Water Right Analyst 3
Idaho Department of Water Resources
Telephone (208) 287-4856
Fax (208) 287-6700 (attn: Dan Nelson)

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These data highlighted in gray below are the original design engineer's numbers for the heat loss/heat gain analysis for the Long Valley facility.

	Electric Consumption (kWh)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cooling demand, Mini Split	Space Cool	0	0	0	13.04	26.9	331.79	771.39	585.76	198.63	16.06	0	0	1943.57
	Heat Reject.	0	0	0	0	0	0	0	0	0	0	0	0	0
	Refrigeration	0	0	0	0	0	0	0	0	0	0	0	0	0
Heat Pump heat required	Space Heat	5055.89	3470.81	2884.8	1434.39	547.7	52.57	1.46	4.63	236.61	1193.73	3073.89	4645.09	22601.57
Electric unit heaters strip heat	HP Supp.	920.93	368.92	250.07	97.14	19.95	0	0	0	11.86	65.6	301.39	744.88	2780.74
Domestic Water Heating	Hot Water	204.92	191.72	212.32	216.36	202.14	171.21	173.58	165.97	152.53	173.57	163.49	192.65	2220.49
Fan Power	Vent. Fans	508.81	427.09	418.66	279.17	210.07	249.18	381.16	331.52	204.5	263.07	424.2	495.49	4192.94
Pump Power	Pumps & Aux.	5402.58	4292.89	3766.03	2044.5	963.76	677.42	866.93	735.88	707.59	1757.18	3861.16	5185.57	30261.49
External Lighting	Ext. Usage	1648.67	1265.03	1400.57	1355.39	958.39	937.15	968.39	1576.64	1525.78	1576.64	1595.49	1648.67	16466.81
Computers	Misc. Equip.	1144.68	1035.39	1144.68	1185.78	1190.32	1093.41	1190.87	1190.32	1093.41	1190.32	1046.67	1144.68	13650.51
Lights	Task Lights	0	0	0	0	0	0	0	0	0	0	0	0	0
Lights	Area Lights	2248.6	1858.4	1880.84	1892.18	1786.71	1643.09	1875.28	1873.37	1826.28	2165.87	2054.66	2353.93	23459.23
	Total	17135.09	12910.27	11957.99	8517.94	5915.93	5155.83	6229.07	6464.08	5957.19	8402.04	12520.95	16410.97	117577.36
	KW(H) Energy for heating/cooling	5055.89	3470.81	2884.8	1447.43	574.6	384.36	772.85	590.39	435.24	1209.79	3073.89	4645.09	
The following rows include the data used to calculate the monthly volume of groundwater used for heating and cooling														
	Watts of heat rejection at 4.5 COP (row17*COP)	22,752	15,619	12,982	6,513	2,586	1,730	3,478	2,657	1,959	5,444	13,833	20,903	
	heat rejection in BTU (row19 kWh * 3412 BTU/kWh)	77,628,135	53,290,817	44,293,219	22,273,840	8,822,408	5,901,463	11,866,339	9,064,848	6,682,675	18,575,116	47,196,507	71,370,712	
	Run time in hours (row20 BTU / 399,840 BTU/hr)	194	133	111	56	22	15	30	23	17	46	118	178	
	Supplemental groundwater used per month (row21 hour * 80 gpm*60 min/hr)	911.010	629.710	522.141	265.776	107.321	54.255	108.710	85.872	64.506	200.216	508.582	760.381	
	Annual gallons of water used (sum of row22)	4,524,203												
	Annual acre-feet of water used (cell B25/325851 gallon/AF)		13.9											

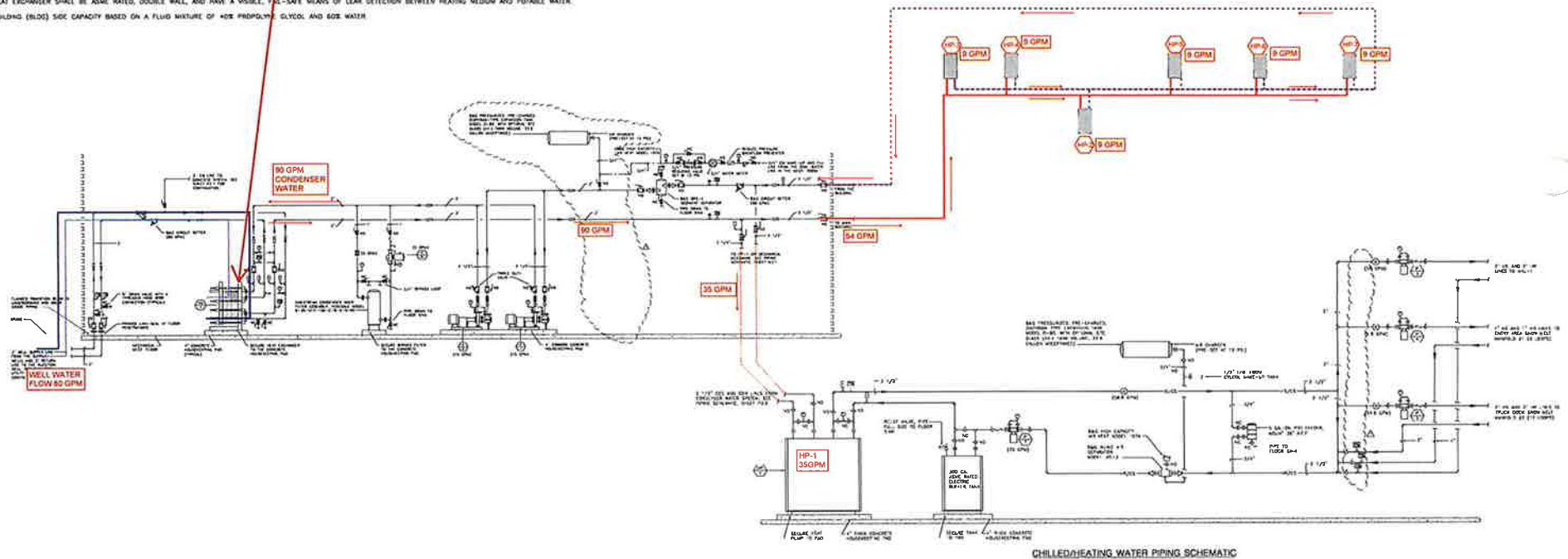
ASSUMPTIONS

1. Coefficient of Performance (COP) = 4.7 @ 68 Deg F for heating.
2. Energy Efficiency Ratio (EER) = 14.8 (BTU/Watt) @ 86 Deg F for cooling. 4.3 COP cooling equivalent.
3. Use 4.5 combined COP. That is 4.5 watts output power/1.0 watt input power.
4. Per drawings: Heat Exchanger is scheduled for 10 degree F delta temperature at 80 GPM or (80 gal min-1) x (1 BTU °F-1 lbs-1) x (10 °F) x (8.33 lbs gal-1) (60 min hour-1) = 399,840 BTU hour-1

HEAT EXCHANGER SCHEDULE

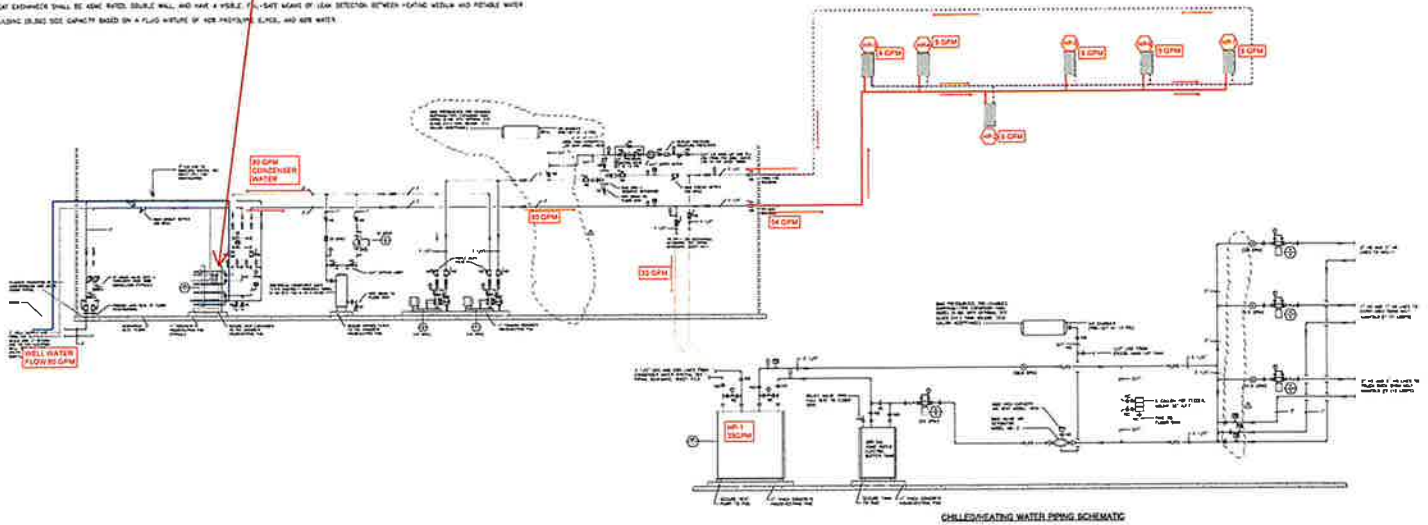
SYMBOL	SYSTEM	BLDG SIDE (FT)		WELL SIDE (FT)		HX FLOW (GPM)		MAX PRESSURE LOSS (PSI)		MANUFACTURER AND MODEL	REMARKS
		ENT	LVC	ENT	LVC	BLDG SIDE	WELL SIDE	BLDG SIDE	WELL SIDE		
	CONDENSER WATER	60.0	#9.1	45.0	55.0	60.0	80.0	2.0	1.8	MUELLER ACQU-THERM MODEL AT40NH	1234

- APPROVED ALTERNATE MANUFACTURERS: BELL & GOSSETT, FLOWTEK, AND AMSTERDAM.
- PIPING CONNECTIONS TO HEAT EXCHANGER AS SHOWN ON PIPING SCHEMATICS MAY NOT REFLECT EACH MANUFACTURER'S ACTUAL CONNECTION ORDER.
- HEAT EXCHANGER SHALL BE ASME RATED, DOUBLE WALL, AND HAVE A VISIBLE, FAIL-SAFE MEANS OF LEAK DETECTION BETWEEN HEATING MEDIUM AND POTABLE WATER.
- BUILDING (BLDG) SIDE CAPACITY BASED ON A FLUID MIXTURE OF 40% PROPYLENE GLYCOL AND 60% WATER.



HEAT EXCHANGER SCHEDULE									
SYSTEM	SYSTEM	BLU. SIDE (°F)		WELL SIDE (°F)		W. FLOW (GPM)		W. PRESSURE (PSI)	
		ENT	LE	ENT	LE	BLU. SIDE	WELL SIDE	BLU. SIDE	WELL SIDE
CONDENSER WATER		60.0	45.1	60.0	45.0	60.0	60.0	2.0	1.0

- APPROXIMATE MANUFACTURER'S REL. & CORRECT, TOLERANCE AND ADJUSTING
- PIPE CONNECTIONS TO HEAT EXCHANGER AS SHOWN ON PIPING SCHEMATICS WILL NOT REFLECT EACH MANUFACTURER'S ACTUAL CONNECTION ORDER
- HEAT EXCHANGER SHALL BE ASSESSMENT, DOUBLE WALL, AND HAVE A POSITIVE 1" SAFE DETECTION BETWEEN HEATING MEDIA AND POTABLE WATER
- BLU. SIDE CAPACITY BASED ON A FLUID MIXTURE OF HOT FRESHWATER, GLACIER, AND WARM WATER



CHILLED/HEATING WATER PIPING SCHEMATIC

Nelson, Dan

From: Nelson, Dan
Sent: Monday, November 23, 2020 2:55 PM
To: 'Boggs, Kevin/BOI'
Cc: Blew, David
Subject: RE: Field Report for Permit 65-23311

Dear Mr. Boggs;

Your request to extend the information required until January 11, 2021, has been granted. You will be required to supply the information in my earlier email on or before this date.

Thank you.

Daniel Nelson
Water Right Analyst 3
Idaho Department of Water Resources
Telephone (208) 287-4856
Fax (208) 287-6700 (attn: Dan Nelson)

From: Boggs, Kevin/BOI [mailto:Kevin.Boggs@jacobs.com]
Sent: Monday, November 23, 2020 2:52 PM
To: Nelson, Dan <Dan.Nelson@idwr.idaho.gov>
Cc: Blew, David <DBlew@idahopower.com>
Subject: Field Report for Permit 65-23311

Hi Dan,

Thanks again for calling me back this afternoon. As we discussed on the phone, we'd like to request an extension of time for responding to your request for clarification in the email below. As you said, let's give plenty of time and pick a date in January. How about January 11th?

Thanks again,

Kevin

208-340-1753

From: Nelson, Dan <Dan.Nelson@idwr.idaho.gov>
Sent: Tuesday, October 27, 2020 2:56 PM
To: Boggs, Kevin/BOI <Kevin.Boggs@jacobs.com>
Subject: [EXTERNAL] Field Report for Permit 65-23311

Dear Mr. Boggs;

I have review the field report you submitted for permit 65-23131. You recommended 0.11 cfs and 0.6 af for domestic use, 0.21 cfs and 76 af for both heating and cooling, and 0.01 cfs and 1.2 af for irrigation of 0.4 acres for a total of 0.33 cfs and 153.8 af. There were several issues that I needed to have clarified in this field report. I have listed each subject below and included attachments to this email to assist in my review.

You also submitted a field report for water right permit 65-23851 at the same time for this facility. Water right permit 65-23851 provides additional irrigation use for this property from the same well and water system. I will hold processing of this permit until the issues are resolved with permit 65-23311, since they utilize the same well and water system.

Point of Diversion Place of Use:

I don't have any issues with the points of diversion and places of use you recommended.

Diversion Rate:

The Pump Capacity:

You were not able to measure the well due to the pipe size and configuration of the piping system. After reviewing your photos, I agree that a measurement isn't possible for this system. You did provide a well driller's report for the system, and the pump curves for the system. You didn't provide any system pressure or the pumping water level of the system. I was able to estimate the pumping water level using the well driller's report, but it was a little vague as to actual pumping water level. The well driller's report states the static level of the well is 47 feet, and the drawdown at 150 gpm was 127 feet. When you add the drawdown to the static level, the pumping water level according to the well driller's report would be 174 feet ($127 + 47 = 174$ feet). The total well depth is 175 feet, so it does seem from the well driller's report that the well is pumped dry when diverted at 150 gpm for 3 hours.

Taking this information into account, I performed several theoretical calculations, and I do believe the drawdown was actually the pumping water level. Taking this information, I performed several calculations. Please see my attached calculation sheet for my calculations. I believe that this system can produce the 150 gpm suggested in the pump curve data from this well.

Domestic Use:

You recommended a diversion rate for domestic use at 0.11 cfs, which was what was permitted. You stated that there are 2 toilets, 2 bathroom sinks, a kitchen fixture, an ice maker, and 4 outside and shop hose spigots. According to the Rural and Domestic Water Use sheet in the Field Examiner's Handbook, a toilet would require approximately 4-5 gpm, the lavatory sinks would require 1-4 gpm, and the kitchen sink would require 2-5 gpm. You stated that the outside spigots flowed at 3 gpm each, but I used the maximum of 5 gpm for the kitchen sink. I estimated the flow rate at $(5 \text{ gpm/toilet} \times 2) + (4 \text{ gpm/lavatory sink} \times 2) + 5 \text{ gpm kitchen sink} + 5 \text{ gpm ice maker} + (4 \text{ outside spigots} \times 5 \text{ gpm/spigot}) = 48 \text{ gpm}$. I then divided the 48 gpm by 448.8 and came up with 0.10695 cfs, which I rounded to 0.11 cfs.

I can agree with your recommendation of a diversion rate of 0.11 cfs for the domestic use, even though I used a different system for calculating the diversion rate for the domestic system than you did.

Heating and Cooling:

You discussed the heating system. You state in the field report that there are 7 heating units. The first heating unit is a water to water unit, and the other 6 units are air to water units. There is very limited information on these units.

Generally, water to water units gather heat from a water source that runs water to a heat exchanger and then is run back to the injection well. The heat drawn from the heat exchanger then exchanges the heat value gathered from the source water to the water in the closed loop system that sends heated water throughout the heating system. The water in the closed loop system is never replaced, so the only water that can be considered as part of the diversion rate would be the flow rate of the source water being delivered to the heat exchanger from the well and back out to the injection well. You stated that the source water delivered to this system runs at 35 gpm or 0.08 cfs.

The other 6 units are described as air to water systems. Our understanding of air to water systems are very similar to the water to water systems, except that they gather heat from an air source and not a water source. Therefore, the only flowing water would be in the closed loop system, which would not need a constant flow of water from the well. There would be no flow rate associated with these units.

I can only recommend a diversion rate of 0.08 cfs for the heating and cooling systems, unless you can supply some additional information that shows additional flow is needed. This can come from design documents and system diagrams that show how the system operates.

Irrigation:

I agree with your calculations for the irrigation use for the 0.4 acres of irrigation. The companion right of this permit, 65-23851, provides additional diversion rate, volume, and acres to the irrigation of this facility, so there shouldn't be any issues with limiting this irrigation rate to 0.01 cfs.

Diversion Volume:

System Capacity:

Based on the pump records, the system capacity would be 0.33 cfs (150 gpm) multiplied by 1.9835 and then multiplied by 365 days a year. This results in a total system capacity of 238.9 af rounded to 239 af.

Domestic Use:

You provided a very good analysis of the water use for the domestic portion of this permit except for the construction workers portion of the analysis. It is considered that construction workers use more water (50 gallons per shift), because they shower at the facility at least once per shift, or that there is a laundry service to clean their clothing. You state in this report that there are no laundry service or showers, so the only water use of the construction workers would only be the bathroom facilities. Therefore, the 9 construction workers should be limited to the same water use as the office workers of 15 gpd. This would reduce the employee use from 0.55 af to 0.229 af ($[15 \text{ employees} \times 15 \text{ gallons per shift} \times 333 \text{ shifts}] / 325850 = 0.229 \text{ af}$). When this is added to the shop use of 0.05 af, the total domestic volume should be limited to 0.279 af rounded to 0.3 af.

I can only recommend a domestic volume of 0.3 af as this stands currently. If you use the 5 gpm for the spigots that I used for the diversion rate calculations, the volume for the shop use would be 0.088 af ($[333 \text{ days} / 7 \text{ days/week}] \times 2 \text{ hrs} \times 60 \times 5 \text{ gpm} = 28,543 \text{ gpy} / 325850 = 0.0876 \text{ af}$). If you add that to the 0.229 af for employee use, that would be 0.317 af rounded to 0.3 af for domestic use. Either way it is the same volume, but it remains consistent with the diversion rate calculations.

Heating and Cooling:

In your analysis, you determined that this system ran non-stop all year long at a diversion rate of 0.21 cfs or 92 gpm, and determined the overall heating and cooling volume at 152 af. You then divided this volume equally as 76 af for heating and 76 af for cooling.

It is very unlikely that this system runs non-stop all year long. There is no discussion of heating degree days, cooling degree days, facility size, or the amount of heat load needed to maintain a preferred heat for this area and this facility. As discussed above, it appears as though this system only operates at a diversion rate of 35 gpm or 0.08 cfs, which would reduce the year round volume from the 152 af you calculate to 57.9 af ($0.08 \text{ cfs} \times 1.9835 \times 365 = 57.9 \text{ af}$) using your method.

It would be extremely inefficient for any heating and cooling system that ran non-stop all year long. It is also highly unlikely that this facility would use the same amount of water for cooling and it does for heating. Cooling generally requires between 5 to 20 % of the water used for heating. You should contact the engineer that installed the system and work with him to provide the water needed, or you could install a measurement device to monitor the water flow into the heating and cooling units for several days so we can extrapolate the annual water needs. We need a full analysis on how much water is needed to operate the heating portion of this system based on the inside design temperature, facility volume, heating degree days, and water needed to provide the heat load for this facility. A separate analysis using the same parameters needs to be done using the cooling degree days for the cooling use.

There is simply not enough information available in the field report to make a reasonable determination of the volume of water needed for the heating use or the cooling use. I recommend that you review the field reports for water rights 37-22542 and 37-22815 for information that may help him determine the volume for both the heating use and the cooling use.

Irrigation:

You correctly determined the irrigation volume of 1.2 af.

The Idaho Beneficial Use Examination Rules 37.03.02.035.02.c states that we can give a certified water right examiner an additional 30 days to supply additional information to clarify the field exam report as stated below.

If the Director determines that a field report prepared by a certified water right examiner is acceptable but that additional information is needed to clarify the field report, he will notify the examiner in writing of the information required. If the additional information is not submitted within thirty (30) days or within the time specified in the written notice, the priority date of the permit will be advanced one (1) day for each day the information submittal is late. Failure to submit the required information within one (1) year of the date of the department's request is cause for the Director to take action to cancel the permit.

Therefore, please supply the above information by November 25, 2020. I can also give you additional time if you give a specific date that you can compile the needed information. If you have any questions, please don't hesitate to contact me.

Respectfully,

Daniel Nelson
Analyst 3
Idaho Department of Water Resources
Telephone (208) 287-4856
Fax (208) 287-6700 (attn: Dan Nelson)

Attachments: Theoretical Calculation Sheet
Rural and Domestic Water Uses Table

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RURAL AND DOMESTIC WATER USES

Residence – Rural:

Each person per day, for all purposes.....	60 gal.
Each horse, dry cow or beef animal per day.....	12 gal.
Each milking cow per day.....	35 gal.
Each hog per day.....	4 gal.
Each sheep per day	2 gal.
Each 100 chickens per day.....	6 gal.

Residence – Urban:

Drinking fountain, continuously flowing.....	50 to 100 gal. per day.
Each shower bath.....	25 to 60 gal.
To fill a bathtub.....	35 gal.
To flush toilet.....	3 to 7 gal.
To fill lavatory.....	1 to 2 gal.
Dish Washing Machine – per load.....	10 to 20 gal.
Automatic washer – per load.....	30 to 50 gal.

By Fixtures:

Shower.....	4 to 6 gpm
Bathtub.....	4 to 8 gpm
Toilet.....	4 to 5 gpm
Lavatory.....	1 to 4 gpm
Kitchen sink.....	2 to 5 gpm

THEORETICAL HORSEPOWER EQUATION WORKSHEET (cjh 1/92)

Water Right No.: 65-23311
 Reviewer: Dan Nelson
 Date of Review: 10/28/2020

P/D No.:

PUMP HORSEPOWER
 BOOSTER HORSEPOWER

PUMPING LEVEL

DISCHARGE PRESSURE

RATE OF FLOW (cfs)
 RATE OF FLOW (gpm)

Scenario #1
15
0
174
50
0.32
143

Scenario #2
15
0
127
50
0.38
171

Scenario #3
15
0
127
61.9
0.34
154

At 68.5 % efficiency
15
0
127
61.9
0.33
150

The above calculates the formula =

$$Q = \frac{8.8 * (\text{Efficiency}) * \text{hp}}{\text{depth to water} + 2.31 * (\text{psi}) + \text{friction}}$$

Assumptions: %70 efficiency.
 No Friction

Examiners Notes:

The certified water right examiner supplied the Horsepower of the well and the well driller's report. The examiner didn't supply the pressure of the system. The well driller's report stated that drawdown was 127 feet and the static water level was 47 feet. This would put the pumping water level at 174 feet (47 feet static + 127 feet drawdown = 174 feet). I am concerned about this PWL, since the total well depth is 175 feet. At a PWL of 174 feet, the well would basically pump the well dry.

Scenario #1 -- I used to suggested PWL of 174 feet. I also used an average pressure of 50 psi. The first scenario shows the diversion rate that would be 0.32 cfs or 143 gpm. I am concerned that the PWL for this Scenario #1.

Scenario #2 -- I feel that the drawdown recorded on the well driller's report was actually included the static water level, so it would be the PWL. I then did a second estimate based on the 50 psi, which showed a diversion rate of 0.38 cfs or 171 gpm.

Scenario #3 -- The pump curves and the pump data performance data sheet suggest that this pump is rated to operate at 150 gpm at 270 feet of total dynamic head. With a drawdown of 127 feet, this would require a 143 feet (61.9 psi) of pressure. Using this with the standard of 70 % of efficiency the well would produce 154 gpm. This suggest that the efficiency would be approximately 68.5 % (see above).

Conclusion -- The pictures confirm that this system cannot be measured by a measurement device due to the piping configuration. Based on the above analysis, I feel a diversion rate of 0.33 cfs or 150 gpm is reasonable.

MEMORANDUM

TO: Water Right File 65-23851

FROM: Daniel Nelson – Analyst 3

DATE: October 28, 2020

SUBJECT: Licensing Review of Water Right 65-23851

The field exam for this right was performed by Certified Water Right Examiner Kevin Boggs of Jacobs Engineering. Mr. Boggs recommended 0.07 cfs and 6.6 af for the irrigation of 2.2 acres.

Mr. Boggs also submitted a field report for water right permit 65-23311 at the same time for this facility. Water right permit 65-23311 provides additional 0.4 acres of irrigation use for this property from the same well and water system along with other industrial type uses for the building.

Point of Diversion Place of Use:

I don't have any issues with the points of diversion recommended by Mr. Boggs. I was only able to find approximately 2.1 acres irrigated, and Mr. Boggs found 2.2 acres irrigated. The difference between these two amounts is insignificant, and could be based on the placement of several of the lines in our mapping system. Therefore, I am going to go with Mr. Boggs' recommendation.

Diversion Rate and Volume:

The Pump Capacity:

Mr. Boggs was not able to measure the well due to the pipe size and configuration of the pump system. After reviewing Mr. Boggs' photos, I agree that a measurement isn't possible for this system. Mr. Boggs did provide a well driller's report for the system, and the pump curves for the system. Originally, Mr. Boggs didn't provide any system pressure or the pumping water level of the system. However, in an email dated January 7, 2021, Mr. Boggs confirmed that the pumping water level was 127 feet. He was still unable to give me the system operating pressure.

Mr. Boggs' recommended diversion rate of 0.07 cfs is a reasonable flow rate for the number of acres being irrigated. Since water right 65-23851 authorizes a diversion rate of 0.07 cfs and

water right 65-23311 authorizes a diversion rate of 0.30 cfs from the same pump, and the capacity of the pump is limited to 0.33 cfs, both permits 65-23851 and 65-23311 will need a condition that limits the use of both rights when combined to 0.33 cfs.

Based on the acre amounts, the diversion rate and volumes were correctly calculated, and I will go with Mr. Boggs' recommendation.

Conditions:

Conditions R66, X59, and X60 will be carried forward to licensing. Condition 121 will be changed to condition 103 as is standard. An X35 condition will be needed to limit the diversion rate when water rights 65-23851 and 65-23311 are combined to the capacity of the system or 0.33 cfs. I am adding condition 944 to this permit. Please see below:

PLEASE NOTE: The permit holder does have shares that allows them to use Lake Irrigation District water. They claimed at permitting and at licensing that they didn't have the infrastructure to access this water. Condition 944 is generally placed on all permits where the owner has shares, but can no longer access the water. This condition was not included at 105 permitting. Condition ~~065~~, which is similar to this condition was included on permit 65-23311. Since these two permits use the same well and irrigation system, condition 944 should be included on both rights. The Department generally doesn't add these types of conditions onto licenses when they are not on the permit, but it would create a tremendous amount of confusion if one the rights had the condition and the other one did not. Since condition 105 was used by itself on water right 65-23311 without including condition 065, we will remove the second sentence of that condition when we add it to this license similar to what we did with 65-23311.

Nelson, Dan

From: Kevin.Boggs@jacobs.com
Sent: Sunday, September 13, 2020 11:12 AM
To: Nelson, Dan
Subject: 65-23851 Draft Beneficial Use Submittal

Jacobs File Transfer System

Kevin.Boggs@jacobs.com has sent you a file archive, with the following message:

Hi Dan,

I am trying out our large-file sharing system. Wondering if you could take a look at this draft submittal before I formalize it for the final, signed and stamped submittal.

Thanks,
Kevin

208-340-1753

If you trust Kevin.Boggs@jacobs.com, use the URL below to pick up the file archive (you may need to copy and paste it into your browser):

Download URL: <https://jfft.jacobs.com/download.aspx?ID=2ca10c35-0946-4798-a809-15536b7cf8ab&RID=26d25fb0-8566-456a-b4c5-0c2e1f351323>

Download size: 24,976 KB

Download contents: 65_23851_beneficialusesubmittal_draft_13sep2020.pdf

Distribution:

To: Dan.Nelson@idwr.idaho.gov, Kevin.Boggs@jacobs.com

Cc:

You have 10 days to pick up this file archive; after 10 day(s) (Midnight 9/23/2020), it will be deleted. This is an automated e-mail. Thank you for using the Jacobs File Transfer System.



State of Idaho

DEPARTMENT OF WATER RESOURCES

Western Region • 2735 W Airport Way • Boise ID 83705-5082

Phone: (208) 334-2190 • Fax: (208) 334-2348

Website: idwr.idaho.gov • Email: westerninfo@idwr.idaho.gov

BRAD LITTLE
Governor

GARY SPACKMAN
Director

September 6, 2019

IDAHO POWER CO
PO BOX 70
BOISE, ID 83707

COPY

RE: Water Appropriation Permit 65-23311

Notice of Intent to Void Permit

Dear Permit Holder:

On October 16, 2008 IDWR issued permit 65-23311 authorizing Idaho Power Co. to develop a right to divert 0.360 cfs of water from GROUND WATER within the SW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 3, Township 17 North, Range 03 East, B.M., for IRRIGATION, HEATING, COOLING, and DOMESTIC purposes in Valley County. Under the terms of the permit, the development was to have been completed by November 1, 2009. On September 4, 2009, IDWR received a Proof of Beneficial Use statement indicating development had been completed and water had been put to beneficial use.

On April 29, 2019 IDWR mailed letters to contact the permit holder in order to schedule a field examination to verify the water use in order to issue a water right license, or submit a relinquishment or assignment of permit form, to which none have been received to date.

The final step in the water appropriation process is the issuance of a Water Right License. By issuing a license, IDWR recognizes that you have met the requirements for establishing a water right. If you have not developed a beneficial use of water within the development period authorized by your permit, however, no water right has been established, and no license can be issued. Once the development period authorized by your permit expires, your permit cannot be retained to cover future development of the resource.

If you believe a water right license should be issued to you, please contact me within the next fourteen (14) days at (208) 334-2190 schedule an examination to demonstrate that beneficial use has been developed. If I do not receive the requested information from you within fourteen days, I will take action to void permit 65-23311 under the provision of Section 42-219(8) of the Idaho Code. If you agree that no beneficial use of water occurred under permit 65-23311, you can shorten the voiding process by completing the enclosed relinquishment form and returning it to IDWR. If you no longer own the place of use property identified in the permit, please submit the enclosed Assignment of Permit form with the applicable \$25 processing fee.

If you have any questions, please contact me at 208-334-2190.

Respectfully,

Justin Shearer
Water Resource Agent, Sr.

Enclosure: Relinquishment of Permit, Assignment of Permit



State of Idaho

DEPARTMENT OF WATER RESOURCES

Western Region • 2735 W Airport Way • Boise ID 83705-5082

Phone: (208) 334-2190 • Fax: (208) 334-2348

Website: idwr.idaho.gov • Email: westerninfo@idwr.idaho.gov

BRAD LITTLE
Governor

GARY SPACKMAN
Director

April 29, 2019

IDAHO POWER CO
PO BOX 70
BOISE ID 83707

CONF

RE: Scheduling Field Exam for Water Right Permit No. 65-23311

Dear Permit Holder:

We are planning to conduct water right examinations in the vicinity of the above-referenced permit **this season**. An examination is needed to verify the water use in order to issue a water right license.

The above-referenced permit authorizes **0.360 CFS** from **GROUNDWATER** for **IRRIGATION, HEATING, COOLING, & DOMESTIC** uses. **If you have developed a beneficial use and still own the place of use property, please contact me at your earliest convenience to schedule an examination.**

If you did not develop a beneficial use of water under the permit during the beneficial use period, a license cannot be issued and the permit should be relinquished. If that use was developed, but have ceased using the water and you currently carry no interest in it, please relinquish the permit by submitting the enclosed Relinquishment of Permit form (no fee required).

If you did develop a beneficial use of water under the permit, but you no longer own the place of use property identified in the permit, please submit the enclosed Assignment of Permit form with the applicable \$25 processing fee.

Please contact me within the next thirty (30) days at (208) 334-2190 to either schedule an examination or submit a relinquishment or assignment form. If you no longer own the place of use property and/or do not respond to this letter, the department will work with the current property owner to issue a license or void the permit.

Sincerely,

Justin Shearer
Water Resource Agent, Sr.

Enclosures: Relinquishment of Permit form
Assignment of Permit form
Water Permit Report and Map

THEORETICAL HORSEPOWER EQUATION WORKSHEET (cjh 1/92)

Water Right No.: 65-23311
 Reviewer: Dan Nelson
 Date of Review: 10/28/2020

P/D No.:

PUMP HORSEPOWER
 BOOSTER HORSEPOWER

PUMPING LEVEL

DISCHARGE PRESSURE

RATE OF FLOW (cfs)
 RATE OF FLOW (gpm)

Scenario #2
15
0
127
50
0.38
171

Scenario #3
15
0
127
61.9
0.34
154

At 68.5 % efficiency
15
0
127
61.9
0.33
150

The above calculates the formula =

$$Q = \frac{8.8 * (\text{Efficiency}) * \text{hp}}{\text{depth to water} + 2.31 * (\text{psi}) + \text{friction}}$$

Assumptions: %70 efficiency.
 No Friction

Examiners Notes:

The certified water right examiner supplied the Horsepower of the well and the well driller's report. The examiner didn't supply the pressure of the system. The well driller's report stated that drawdown was 127 feet and the static water level was 47 feet. This would put the pumping water level at 174 feet (47 feet static + 127 feet drawdown = 174 feet). I was concerned about this PWL, since the total well depth is 175 feet. At a PWL of 174 feet, the well would basically pump the well dry. I contacted the field examiner and he confirmed the pumping water level was 127 feet.

Scenario #2 -- I feel that the drawdown recorded on the well driller's report was actually included the static water level, so it would be the PWL. I then did a second estimate based on the 50 psi, which showed a diversion rate of 0.38 cfs or 171 gpm.

Scenario #3 -- The pump curves and the pump data performance data sheet suggest that this pump is rated to operate at 150 gpm at 270 feet of total dynamic head. With a drawdown of 127 feet, this would require a 143 feet (61.9 psi) of pressure. Using this with the standard of 70 % of efficiency the well would produce 154 gpm. This suggest that the efficiency would be approximately 68.5 % (see above).

Conclusion -- The pictures confirm that this system cannot be measured by a measurement device due to the piping configuration. Based on the above analysis, I feel a diversion rate of 0.33 cfs or 150 gpm is reasonable.

RECEIVED

OCT 01 2020

DEPARTMENT OF
WATER RESOURCES

Jacobs

TRANSMITTAL

To: Idaho Department of Water Resources
322 East Front Street
Suite 600
Boise, ID 83702

From: Kevin Boggs
Jacobs
999 W. Main St. Suite 1200
Boise, ID 83702
208-340-1753

Attn: Dan Nelson

Date: 9/29/2020

Re: Idaho Power Company 65-23851 Statement of Completion and Beneficial Use Field Report

We Are Sending You:

Method of shipment:

X Attached

Under separate cover via

Shop Drawings

Documents

Tracings

Prints

Specifications

Catalogs

Copy of letter

Other:

Quantity	Description
1	Idaho Power Company Water Right 65-23851 Statement of Completion
2	Idaho Power Company Water Right 65-23851 Beneficial Use Field Exam Report

If the material received is not as listed, please notify me at 208-340-1753.

Copy To: David Blew, Idaho Power Company

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

RECEIVED
OCT 01 2020
DEPARTMENT OF
WATER RESOURCES

A Beneficial Use Field Report is prepared by a water right examiner as the result of an examination to clearly confirm and establish the extent of the beneficial use of water established in connection with a permit during the development period authorized by the permit and any extensions of time previously approved.

A. GENERAL INFORMATIONPermit No. 65-238511. Owner Idaho PowerPhone No. (208) 388-2602Current address C/O Kresta Davis-Butts, P.O. Box 70, Boise, ID 837022. Examiner's name Kevin BoggsEXAM DATE 8/13/20203. Accompanied by David BlewEmail DBlew@idahopower.comAddress 1221 W Idaho Street, Boise, ID 83702Relationship to permit holder Idaho Power EmployeePhone No. (208) 954-98304. Source Groundwatertributary to N/A**B. OVERLAP REVIEW**1. Other water rights with the same place of use 65-233112. Other water rights with the same source and point of diversion 65-23311**C. DIVERSION AND DELIVERY SYSTEM**

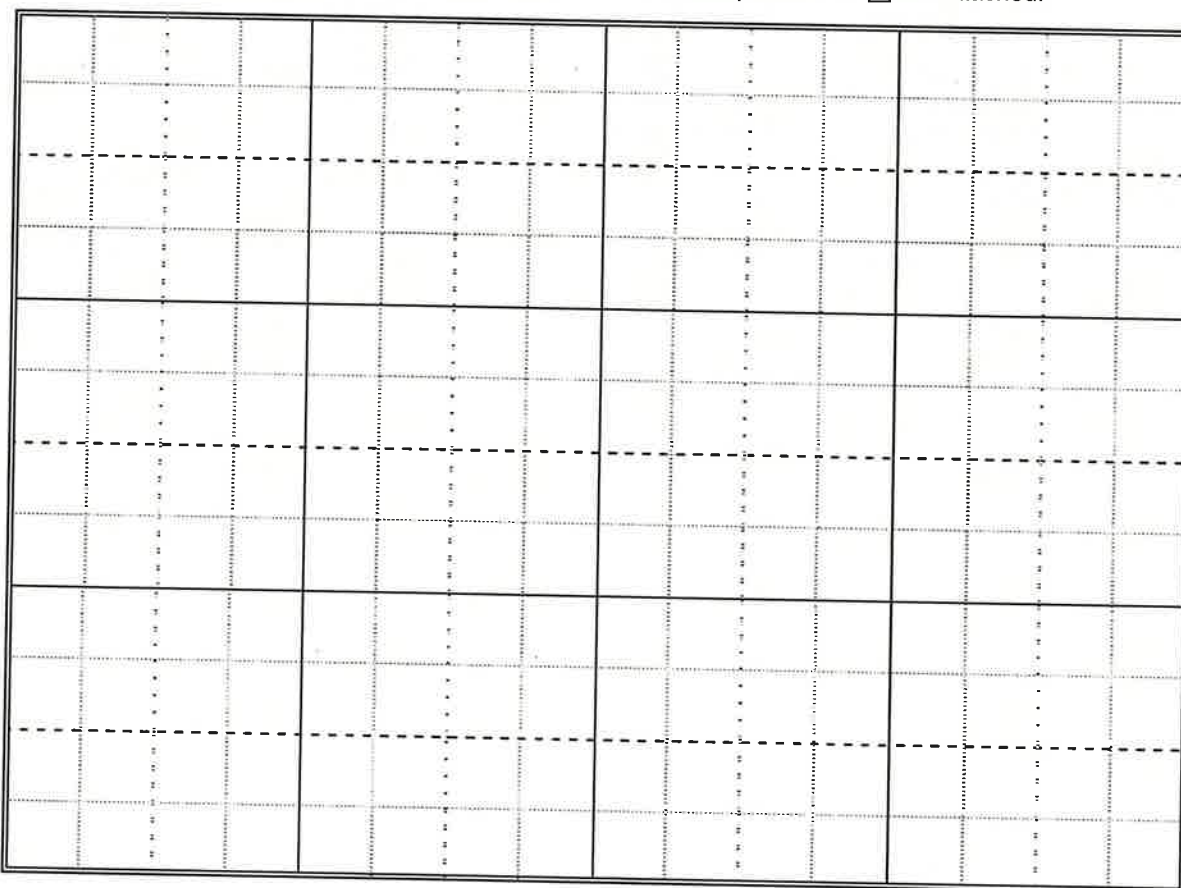
1. Point(s) of Diversion:

Ident. No.	Gov't Lot	¼	¼	¼	Sec	Twp	Rge	County	Method of Determination/Remarks
			SW	SW	3	17N	03E	Valley	Records review and site visit

2. Place(s) of Use: Method of determination Records review and site visit. See attached map.

Twp	Rge	Sec	NE				NW				SW				SE				Totals
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
17N	03E	3											2.2						2.2

3. **Delivery System Diagram:** Indicate all major components and distances between components. Indicate weir size/ditch size/pipe diameter (inside), as applicable. Use the space provided or ☐ see attached.



Scale: 1" = _____

- ☐ 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
Production Well	Berkeley	15	2084102462	Berkeley	6T15-155

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

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date
See attached narrative						

2. Measurements: _____

E. NARRATIVE/REMARKS/COMMENTS

See attached narrative

Has the permit holder met all conditions of permit approval, including any mitigation requirements and/or measuring device installation requirements? ☒ Yes ☐ No If no, what must be done to meet the permit requirements?



F. FLOW CALCULATIONS☐ Additional computation sheets attached

Measured Method:

See attached narrative

G. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation:

$$V_{I.R.} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) = 2.2 \text{ acres} \times 3 \text{ acre-feet per acre} = 6.6 \text{ acre-feet}$$

$$V_{D.R.} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation Season}) \times 1.9835 = 0.07 \text{ cfs} \times 199 \text{ days} \times 1.9835 = 27.6 \text{ acre-feet}$$

$$V = \text{Smaller of } V_{I.R.} \text{ and } V_{D.R.} = 6.6 \text{ acre-feet}$$

2. Volume Calculations for Other Uses:

See attached narrative.

H. RECOMMENDATIONS

1. Recommended Amounts

Beneficial Use	Period of Use		Rate of Diversion Q (cfs)	Annual Volume V (afa)
	From	To		
Irrigation	4/15	10/31	0.07	6.6
Totals:				

2. Recommended Amendments

☐ Change P.D. as reflected on page 1☐ Add P.D. as reflected on page 1☐ None☐ Change P.U. as reflected on page 1☐ Add P.U. as reflected on page 1☐ Other**I. AUTHENTICATION**

Field Examiner's Signature

Kevin B. ...

Date

9/29/2020

Reviewer

Date



Attachment A. Beneficial Use Field Exam Narrative 65-23851

Attachment A.

Beneficial Use Field Exam Narrative – Idaho Power Company Water Right No. 65-23851

Water Right 65-23851 Background Information

Water Right No. 65-23851 is associated with Idaho Power Company's (IPC) Long Valley Operation Center located in Lake Fork, ID 83638 (Figure 1). IPC has an existing pumping well (Appendix 1 – Well Driller's Log) and injection well on site. The pumping well is the point of diversion for Water Right 65-23851 and 65-23311. The place of use for these two rights, along with the point of diversion and injection well, is located in Township 17N, Range 3E, Section 3, SW¼SW¼.



Figure 1. General site map with the approximate Long Valley Operation Center property boundary and the approximate locations of the pumping well (POD for rights 65-23852 and 65-23311) and injection well.

Existing Water Rights

There are two water rights with the same place of use

- 65-23851
- 65-23311

IPC owns shares in the Lake Irrigation District. However, as detailed in the water right permit application, IPC does not have infrastructure in place to deliver these shares to IPC's Long Valley Operation Center property. This fact was verified during the beneficial use field exam (Appendix 2 – Field Photos).

Water Right 65-23851 Place of Use

The places of use for water right No 65-23851 is Township 17N, Range 3E, Section 3, SW¼SW¼.

Delivery System and Water Usage

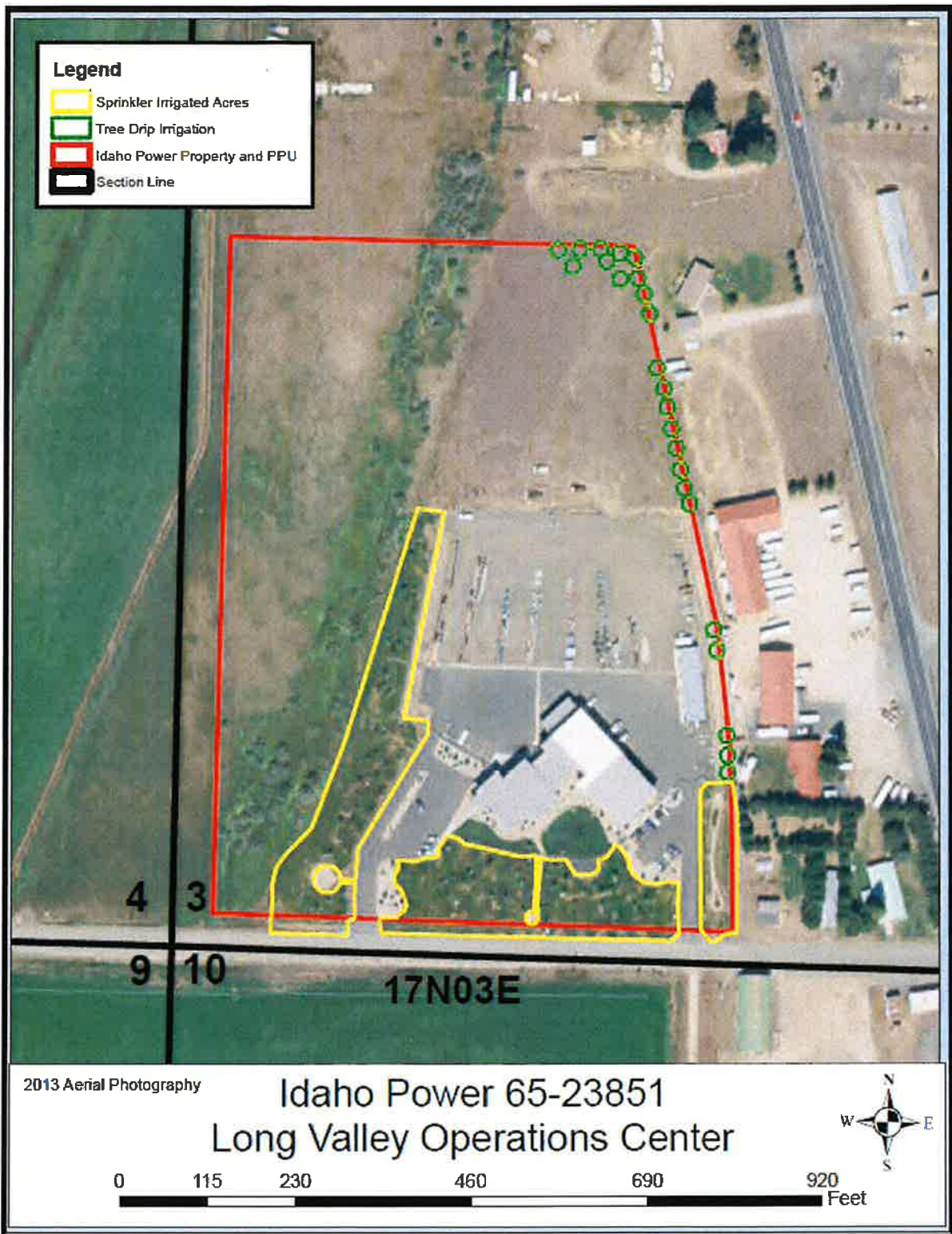
Water from the pumping well is pumped through a closed-loop heating and cooling system then injected back to the aquifer. Water from the pumping well is also pumped to a 119-gallon pressure tank located in the Operation Center facility to serve domestic water demands. Water from the well is also used to pressurize the on-site irrigation system. The heating, cooling, and domestic uses, along with irrigation of 0.4 acre are associated with water right 65-23311. Water right 65-23851 includes irrigation of 2.2 acres of land (Table 1 and Figure 2).

Table 1. Irrigated Acres at the Long Valley Operations Center		
Water Right 65-23851	Sprinkler Irrigated Areas (ac)	Tree Drip Irrigation (ac)*
	0.22	0.17
	0.84	
	0.93	
Total Acres	1.99	0.17

*Assume 24 trees and 314 sqft/tree (10 ft radius)

Fire Suppression

IPC has a fire suppression pump that pressurizes a hydrant and a fire suppression sprinkler system in the event of a fire. Water from the production well is stored under the floor of the Operation Center in a vault. The fire pump intake is in this vault. This water is only used to suppress a fire in the event of an emergency.



Appendix 1. Production Well Driller's Log 65-23851

IDAHO DEPARTMENT OF WATER RESOURCES WELL DRILLER'S REPORT

1. WELL TAG NO. D D0053011

Drilling Permit No. _____

Water right or injection well # _____

2. OWNER

Name **Idaho Power Co.**

Address **P.O. Box 1954**

City **McCall**

State **Id**

Zip **83638**

3. WELL LOCATION:

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

Sec. **3** SW 1/4 SW 1/4 SW 1/4

Gov't Lot _____

County **Valley**

Lat. **44° 50'00" 287"N** (Deg. and Decimal minutes)

Long. **116° 05'13" 721"W** (Deg. and Decimal minutes)

Address of Well Site **30 W. Lakefork Rd.**

City **Lakefork**

Block of land name of road - Distance to Road or Landmark

Lot _____ Blk. _____

Sub. Name _____

4. USE:

☒ Domestic ☐ Municipal ☐ Monitor ☐ Irrigation ☐ Thermal ☐ Injection
☐ Other _____

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
5/8 Bentonite	0	20	600 lbs.	12" Overbore

8. CASING/LINER:

Diameter (nominal)	From (ft)	To (ft)	Gauge/Schedule	Material	Casing	Liner	Threaded	Welded
8"	2	141	.250	Steel	☒	☐	☐	☒
5"	139	144	.258	Steel	☐	☒	☐	☒
5"	174	175	.258	Steel	☐	☒	☐	☒

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) **141'**

9. PERFORATIONS/SCREENS:

Perforations ☐ Y ☒ N Method _____

Manufactured screen ☒ Y ☐ N Type **Johnson**

Method of installation **Pullback**

From (ft)	To (ft)	Slot size	Number/ft	Diameter (nominal)	Material	Gauge or Schedule
144	174	.020	30'	5"	Stainless	304

Length of Headpipe **5'**

Length of Tailpipe **1'**

Packer ☒ Y ☐ N Type **Rubber K-Packer**

10. FILTER PACK:

Filter Material	From (ft)	To (ft)	Quantity (lbs or ft ³)	Placement method
N/A				

11. FLOWING ARTESIAN:

Flowing Artesian? ☐ Y ☒ N Artesian Pressure (PSIG) _____

Describe control device _____

12. STATIC WATER LEVEL and WELL TESTS:

Depth first water encountered (ft) _____ Static water level (ft) **47'**

Water temp. (°F) _____ 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
127'	150 GPM	3 HRS.	☒	☐	☐	☐

Water Quality test or comments: _____

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	3	Top Soil		☒
	3	11	Sandy Brown Clay		☒
	11	20	Brown Coarse Sand w/ Clay		☒
8"	20	22	Brown Coarse Sand w/ Clay		☒
	22	37	Gravel		☒
	37	46	Clay w/ Gravel		☒
	46	47	Brown Clay		☒
	47	62	Sand & Gravel	☒	
	62	75	Sandy Brown Clay		☒
	75	115	Gravel	☒	
	115	122	Brown Clay		☒
	122	126	Sand	☒	
	126	138	Brown Clay		☒
	138	157	Coarse White Sand	☒	
	157	158	Clay		☒
	158	174	Coarse White Sand	☒	
	174	175	Clay		☒

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AUG 6 4 2008

WATER RESOURCES
WESTERN REGION

Completed Depth (Measurable) _____

175'

Date: Started **7/17/08**

Completed **7/29/08**

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 **Dennis Phipps Well Drilling Inc.** Co. No. **332**

*Principal Driller **[Signature]** Date **7/30/08**

*Driller **[Signature]** Date **7/30/08**

*Operator II **Mike Kurtz** Date **7/30/08**

Operator I _____ Date _____

* Signature of Principal Driller and rig operator are required.

Appendix 2. Field Photos 65-2385 1



Production well



Injection well



Operations center office building



Irrigated area to the west of the office building



Irrigated area to the west of the office building



Irrigated area to the west of the office building (sprinkler on in the foreground)



Irrigated trees near the production well to the west of the office building



Landscaping at the entrance to the office building



Irrigated area to the south of the office building



Irrigated area to the southeast of the office building



Irrigated area to the southeast of the office building



Irrigated area to the south of the office building



Irrigated area to the southwest of the office building



Irrigated area to the southeast of the office building



Irrigated area to the east of the office building



Irrigated area to the southeast of the office building



Irrigated area to the northeast of the office building



Irrigated area to the northeast of the office building



View from the approximate location of the surface water diversion for neighboring property (Lake Irrigation District)



Surface water diversion, old check structure (Lake Irrigation District)



Surface diversion for neighboring property looking downstream (Lake Irrigation District)



Surface water diversion, old check structure (Lake Irrigation District)

Appendix 3. Production Well Pump Curve 65-23851

MAR-06-2007 10:30 From: ABB TECH SUPPORT

ABB Inc.
18250 West Glendale Dr
New Berlin, WI 53151**ABB**Warranty Registration Form
F-3BUAC9815028
Rev B, Jan. 16, 2007**Certified Start-Up Extended Warranty Registration**

This form is to be used by factory authorized personnel only for ABB drive product warranty registration as part of the Certified Start-Up program. This form must be completed in its entirety and submitted to the ABB drives Technical Support within 10 days from start-up to receive warranty extension. For AC & DC drives, email to DrivesSupportLine@us.abb.com with subject line "Certified Start-Up". For AC drives only, we will continue to accept faxed forms @ 262-780-5135, for the near term.

* All procedures and requirements as documented in the user Manuals for the product you are commissioning must be followed.

End User Installation site		Start-Up Date: 4 FEB 09	
Company Name BURGESS Pump CO	Contact Name DAN Byler	Contact Phone 208 585 6202	
Street Address 706 star Blvd	City middletown	State ID	Zip Code 83644
		Country USA	
Purchased From		Supplier Type:	
Company Name Platt	City Nampa	State ID	Contact Name FREDDY
		Contact Phone 461-3289	
Drive Product Information		Software Revision code	
Model Number (Type Code) ACS530-U1-031A-4	Serial Number 2084102462	312BHFX	
Application Information		Operation mode	
Industry type commercial	Application type Pump	Drive control mode Scalar/Freq	PID
Motor Information			
Select motor type AC motor	Motor HP: 15	Voltage: 460	RPM: 3450
		FLA: 20.8	Freq: 60
Installation Checks - Mechanical			
Mechanical Installation	☒	Control (I/O, Feedback)	☐
Cable Connections	☒	Ambient Temperature	☒ VAR
Proper Grounding	☒	Drive Unit cooling / Air flow	☒
Input Fuses	☒	Motor disengaged	☐
Wire run to/from motor	☒	Safe to operate machine	☒
Motor cable length	☒	AutoTune completed	☐
Installation Checks - Electrical			
Drive disconnected - Megger Cable/Motor:		Reading	
Megger test voltage = 500		T1-PE = 550	T3-PE = 550
		T2-PE = 550	
Input Voltage @ Base Spd	L1-L2 = 491 L2-L3 = 485 L3-L1 = 490	Input Current @ Base Spd	L1 = 6.9 L2 = 5.6 L3 = 5.6
Output Voltage @ Base Spd	T1-T2 = 353 T2-T3 = 353 T3-T1 = 353	Output Current @ Base Spd	T1 = 11.0 T2 = 11.7 T3 = 11.7
Additional Comments			
Performed by: DAN Byler		Registration No: 1310-01	

By submittal of this form you commit that all information provided is accurate to the best of your ability, provided to the customer, and the requirements as listed here and in the product user Manual have been completed.

Berkeley Electronic Catalog

Pump Performance Datasheet

Customer : BURGESS PUMP

Customer reference :

Item number :

Service :

Quantity of pumps : 1

Quote number :

Pump size :

Stages :

Based on curve number :

Data last saved :

: 6715-155

: 6

: 6715-155(6@4.07x3.74)

: 22 Oct 2008 2:47 PM

Operating Conditions

Flow, rated : 160.0 USgpm
 Head, rated (requested) : 240.0 ft
 Head, rated (actual) : 270.4 ft
 Suction pressure, rated / max : 0.00 / 0.00 psi.g
 NPSH available, rated : Ample
 Frequency : 60 Hz

Liquid

Liquid type : Water
 Additional liquid description :
 Solids diameter, max : 0.00 in
 Temperature, max : 68.00 deg F
 Fluid density, rated / max : 0.998 / 0.998 g/cc
 Viscosity, rated : 1.00 cP

Performance

Pump speed, rated : 3,450 rpm
 Impeller diameter, rated : 3.91 in
 Impeller diameter, maximum : 3.91 in
 Impeller diameter, minimum : 3.91 in
 Efficiency : 73.00 %
 NPSH required / margin required : N/A / 0.00
 Ng (imp. eye flow) / Nss (imp. eye flow) : N/A US Units
 MCSF : 48.00 USgpm
 Head, maximum, rated diameter : 359.8 ft
 Head rise to shutoff : N/A %
 Flow, best eff. point (BEP) : 146.7 USgpm
 Flow ratio (rated / BEP) : 109.08 %
 Diameter ratio (rated / max) : 100.00 %
 Head ratio (rated dia / max dia) : 88.78 %
 C_d/C_h/C_e (ANSI/HI 9.6.7-2004) : 1.00 / 1.00 / 1.00
 Selection status : Acceptable

Material

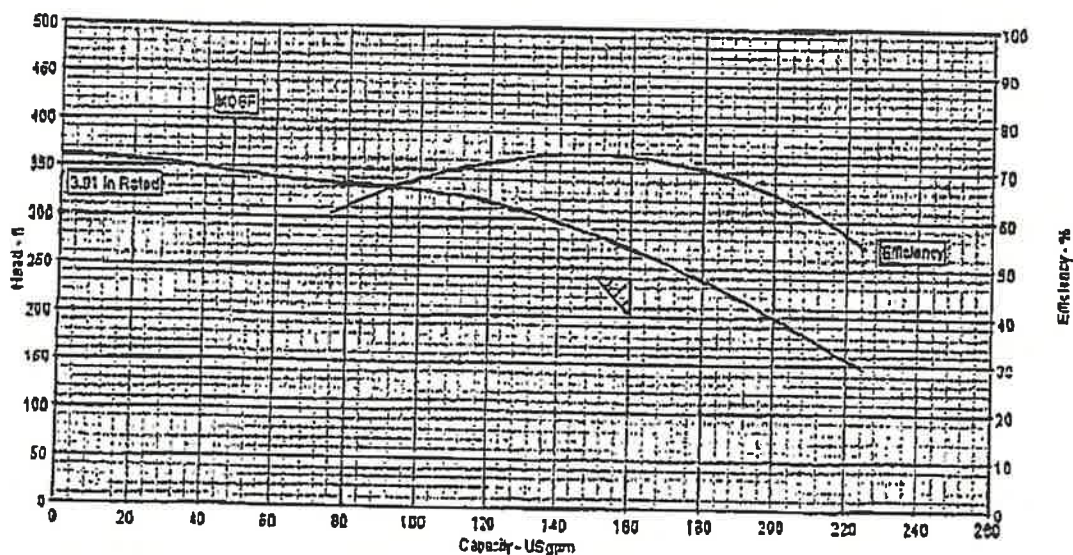
Material requested : Auto
 Material selected : Not specified

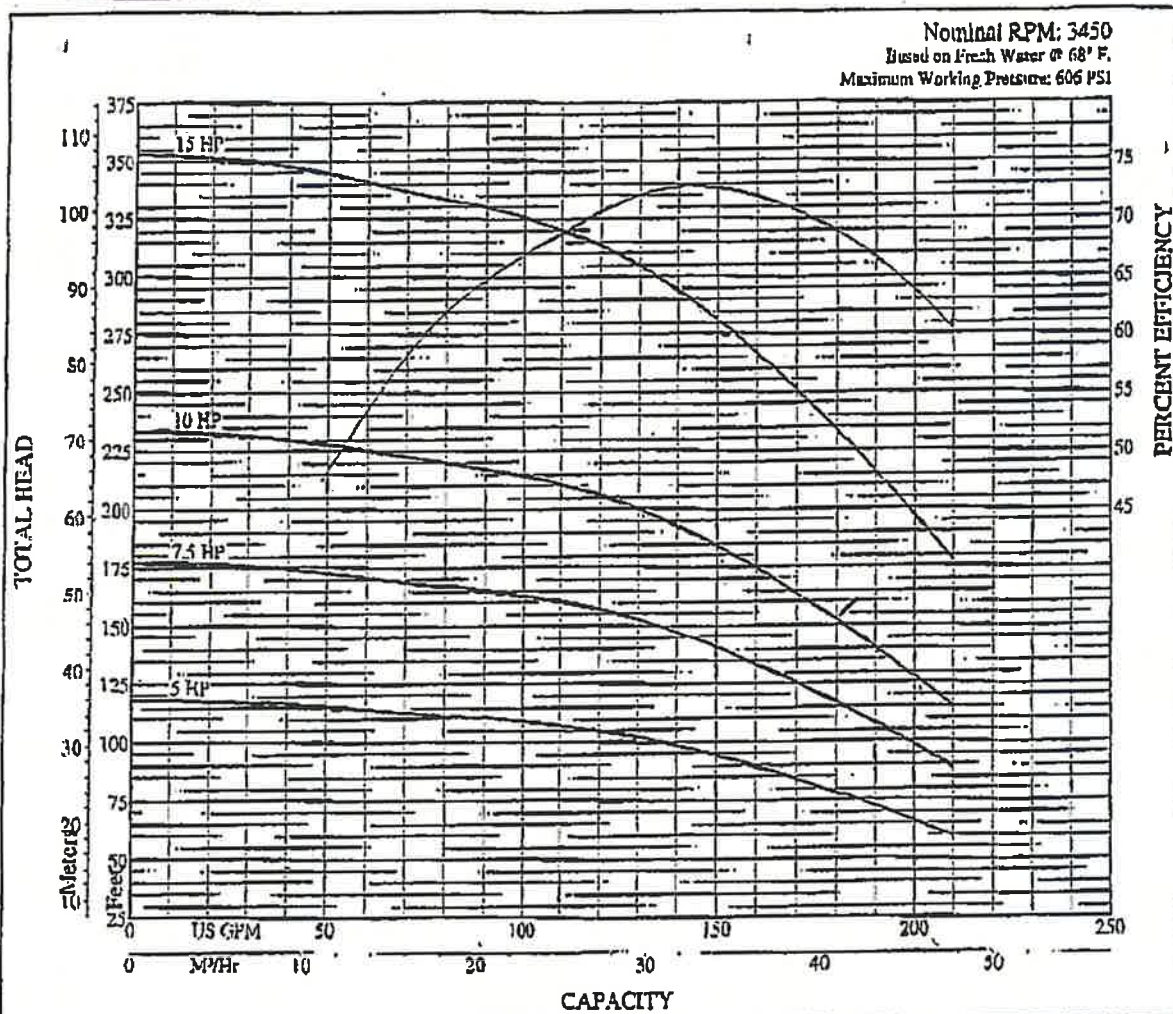
Pressure Data

Maximum working pressure : 155.7 psi.g
 Maximum allowable working pressure : 606.0 psi.g
 Maximum allowable suction pressure : N/A
 Hydrostatic test pressure : N/A

Driver & Power Data

Driver sizing specification : Rated power
 Margin over specification : 0.00 %
 Service factor : 1.15 (used)
 Power, hydraulic : 10.91 hp
 Power, rated : 14.94 hp
 Power, maximum, rated diameter : 15.40 hp
 Minimum recommended motor rating : 15.00 hp / 11.19 kW (Fixed)



BERKELEY**SUBMERSIBLE
TURBINE****6T-155****OUTLINE DIMENSIONS / WEIGHTS**

HP	stages	Motor size	P length	M* length	MD* dia.	Ma' wt.	Pump wt.
5	2	4"	23.25	29.62	3.75	70	73
5	2	6"	23.25	25.44	5.38	105	73
7.5	3	4"	27.88	29.62	3.75	70	91
7.5	3	6"	27.88	28.00	5.38	120	91
10	4	6"	32.50	30.56	5.38	135	109
15	6	6"	41.75	33.13	5.38	146	145

Note: dimensions = inches; weight = U.S. lbs.

M* Maximum length (Franklin Electric Motor)

MD* Motor diameter (Franklin Electric Motor)

SPECIFICATIONS

Minimum Well I.D.	6.0 Inches
Minimum Submergence @ BEP (above Inlet)	10.0 Feet
Capacity Range†	48 ~ 210 GPM
Discharge	3" F NPT

See manufacturer's data for motor cooling requirements

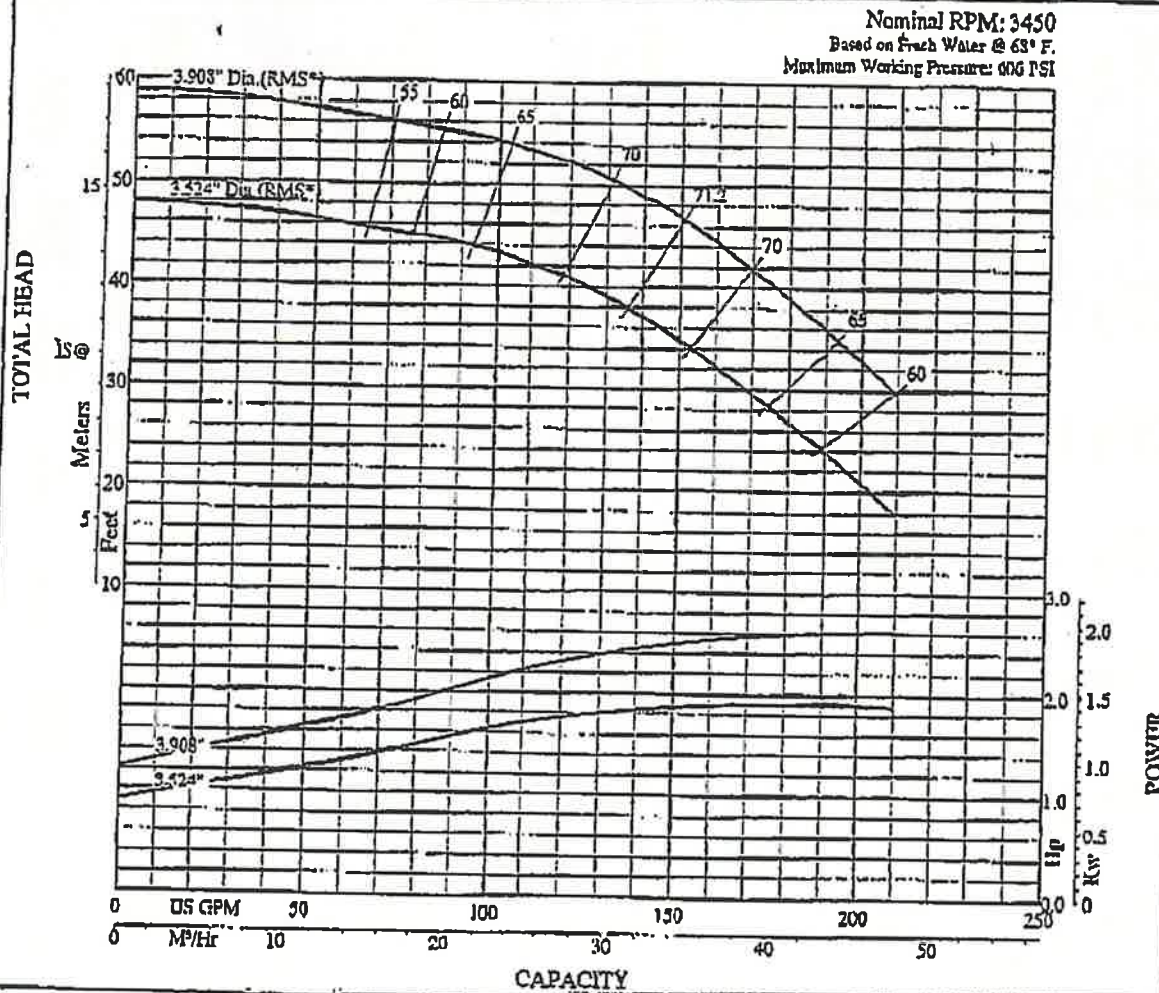
SUPSEDES

Section 3T
Date 01/05/97
Page 12.01

Date 04/15/98

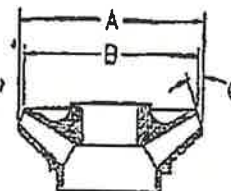
Section **ST**

Page 12.01

BERKELEY**SUBMERSIBLE TURBINE
SINGLE STAGE PERFORMANCE****6T-155****IMPELLER DIMENSIONS**

RMS* Diameter	A Diameter	B Diameter	C Angle
3.908	4.070	3.740	21°
3.524	3.690	3.330	21°

* Root-Mean-Square

**MATERIALS OF CONSTRUCTION**

Part Name	Common Material Name	Material Spec Number
Discharge Adapter	Cast Iron	ASTM A48 Class 30
Top Bowl	Cast Iron	ASTM A48 Class 30
Thrust Washer/Shim	Stainless Steel	AISI 430
Intermediate Bowl	Cast Iron	ASTM A48 Class 30
Bearings, Top and Suction Case	Bronze	ASTM B144-3B (SAE 660)
Impeller	Silicon Bronze	ASTM B564 UNS C97500
Pump Shaft	Stainless Steel	AISI 416
Impeller Collets	Steel	1226
Suction Bracket	Cast Iron	ASTM A48 Class 30
Bowl Bearing	Rubber	Neoprene
Sand Cap	Bronze	ASTM B144-3B (SAE 660)
Strainer	Stainless Steel	AISI 302 UNS S30200
Cable Guard	Stainless Steel	AISI 302 UNS S30200
Shaft Coupling	Stainless Steel	AISI 416 UNS S41600

Note: Efficiency based on average staging

SUPERSEDES

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