

MEMORANDUM

Date: October 27, 2011
To: Water Right File 29-13155
From: medl
Re: license review

The field examiner's beneficial use field report is missing the last 2 pages. The partial report is dated September 6, 2006 and the exam was conducted by a water rights field agent from the IDWR Eastern Region. The examiner would have been familiar with the Tovey system as he had previously examined the use of water for right 29-7866 in June 2000.

The partial report was reviewed by other Eastern Region staff members and supplemented with a full field exam report dated May 25, 2007. Neither the field examiner nor the reviewer recommended a volume for this right, and neither are current IDWR employees and so are not readily available to answer questions.

Applicant

The applicant, Mr. DeVere Tovey is deceased but the license will be issued in his name. Clarification of ownership can be done after the license is issued.

Source, Point of Diversion and Point-of-Discharge

The source of water for this right are springs in Harkness Canyon.

The reviewer states that the field examiner described the diversions as perforated pipe which collected the spring water and directed it into a gravity piping system. I believe that only Tovey property is dewatered by diverting and containing these springs.

Upstream of the turbine, the system piping crosses the camping/picnic area where domestic and irrigation taps can draw off some of the water. The penstock to the hydro turbine is the end of the line. Any water remaining in the system enters Harkness Creek where the turbine discharges.

I reviewed and replotted the GPS points for the springs which were provided on the partial field exam report. I found the GPS points agreed well with the map submitted with the application for permit. However, only one of the four authorized points-of-diversion listed on the permit is correct. An amendment will be needed to add a second point-of-diversion in the NESWSW.

The application for permit 29-13784 and the reviewer's narrative statement for this right, specify that the springs for this right also serve licensed water right 29-7866. The number of springs and the locations of the springs are not the same for the three rights. I believe that the points-of-diversion authorized by the licensed right 29-7866 are in error because the field examiner's report for that right is internally inconsistent. The PLSS quarter-quarter addresses for the PODs and POUs do not match the PLSS grid locations and neither the grids nor the addresses match the locations shown on the field examiner's map. A copy of this memo will be placed in the file for 29-7866.

Water Use

The field examiner measured water flow but did not confirm beneficial use of the water for power generation. No record of watts generated was provided and there was no description of distribution wiring or of the power demand.

The partial report from 2006, lists a Harris Turbine, an Ashcroft 0/60 (which I assume is a pressure gage) and 37 psi (which I assume is the reading from the gage). If the pressure at the turbine was 37 psi, the gage reading converts to $37 \times 2.31 = 85.47$ ft of head.

I believe that the turbine was a Pelton wheel type, hydroelectric turbine-generator manufactured by

Harris. The Harris micro turbine can be fit with 1 to 4 nozzles of various sizes to accommodate variation in flow rate. The examiner does not mention the size or the number of nozzles. However, he recorded 3 flow measurements by isolating the flow through each of 3 different valves on the turbine mounting. I believe that the Tovey turbine had only one penstock and that the valves that the examiner isolated are downstream of the penstock. (See the attached image of a Harris 4-nozzle turbine). The valves allow the permit holder to direct the flow through one or more nozzles as the springflow changes with the season. I believe that the examiner measured the same flow through 3 different nozzle sizes. It was incorrect to sum the measurements and to recommend that total as the flow of water put to use. Without knowing the nozzle sizes, I use the maximum flow measured (47.5 gpm or 0.11 cfs) as the basis for my recommendation and volume calculation.

No battery storage or battery recharge is mentioned so I assume that the power would have been used as it was generated similar to accessing the electrical hook-up at a traditional RV campsite. Assuming the conditions at the time of the field exam, a Harris turbine would have provided 400-500 Watts (0.4-.5 kW) of real-time power (see the attached table). 500 Watts of continuous power can operate lights, refrigerator, freezer, pump and entertainment using standard appliances in a battery-inverter system. It would be sufficient power for use in a single RV. It is not sufficient to meet wintertime heating needs for a comfortable stay in an RV parked in this location and it is not sufficient to simultaneously power six RVs as proposed by the domestic water use rights.

Season of Use

It is unlikely that either the flow measured at the time of the exam or the power use that I have assumed, is constant year-round. I have no information to support the Tovey RV camp as a year-round primary residence. But I am willing to recommend a year-round season-of-use consistent with the companion domestic rights.

Internet research yielded an average number of travel days (~35 days) for RVers but not an average length of stay per year. I would have preferred to have had some information about the RV habits of the Tovey family.

Place of Use

I understand that the turbine which generated power for this use was portable and moved to the site when needed. The GPS for the place-of-use is adjacent to the picnic/RV parking area described in the exam report and map for 29-7866. Although the hydro turbine may be small enough to be carried to other locations, once licensed the only authorized place-of-use will be in the SWSW.

The place-of-use for this right is at 5500 ft elevation, approximately 4 miles as the crow flies NE of McCammon, Idaho. The Tovey family property is an island of private property surrounded by Caribou-Targhee National Forest or BLM lands. There is no access to a utility's power distribution grid.

According to available Bannock County taxlot information, the entire 40-acre tract, which includes the place-of-use, is owned by DeVere Tovey.

Status and Combined Use

The watermaster has conditionally authorized waiver of the permit condition requiring a measuring device and watermaster control. An order to grant the petition will be needed prior to licensing.

The same system appears to serve water rights 29-7866 and 29-13784. This power right (29-13155) will be term-limited and made subordinate to these two rights and any subsequent rights served by this system. However, as long as either of the two rights listed above are maintained, there could be water in the system sufficient for use in power generation.

Calculations

The volume recommendation is missing from the examiner's report. The volume recommended by the reviewer is based on a total of the 3 measurements and is incorrect.

I recommend a rate based on the maximum flow measurement made by the examiner, 0.11 cfs. I recommend a volume based on continuous use for 200 days of the year. This is the length of the irrigation season in Basin 29 and roughly coincides with the number of days with an average temperature of 45 degrees F. I understand this hydropower system relies on gravity flow through pipe from springs. Both would be subject to freezing. I also understand that this is an open-air powerplant, mounted on a trailer and may require repositioning between camping trips.

My volume calculation is $(0.11 \text{ cfs}) \times (200 \text{ days}) \times 1.9835 = 43.6 \text{ AF}$

OUTPUT IN WATTS & EFFICIENCY IN % WITH RECOMMENDED NOZZLE SIZE

versus head and flow

Note that permanent magnet alternator is more efficient and usually produces more output.
(Permanent Magnet Table updated 7/6/2008)

FLOW GPM	PERMANENT MAGNET ALTERNATOR 1500 WATTS MAX						FORD ALTERNATOR (DISCONTINUED) MAX: 750W @ 12V, 1500W @ 24V, 2500W @ 48V							
	NET (DYNAMIC) HEAD PRESSURE						NET (DYNAMIC) HEAD PRESSURE							
	25'	50'	75'	100'	200'	300'	25'	50'	75'	100'	200'	300'		
	11PSI	22PSI	33PSI	43PSI	87PSI	130PSI	11PSI	22PSI	33PSI	43PSI	87PSI	130PSI		
3	-	-	-	-	45W 42% (1)3/32"	80W 49% (1)3/32"	-	-	-	-	30W 28%	70W 43%		
6	-	20W 37% (1)7/32"	30W 37% (1)3/16"	45W 42% (1)5/32"	130W 60% (1)5/32"	180W 56% (1)1/8"	-	-	25W 31%	35W 32%	100W 46%	150W 46%		
10	20W 44% (1)5/16"	50W 56% (1)1/4"	80W 59% (1)1/4"	105W 58% (1)7/32"	225W 63% (1)3/16"	350W 65% (1)5/32"	-	35W 39%	60W 44%	80W 44%	180W 50%	275W 51%		
15	35W 52% (1)3/8"	85W 63% (1)5/16"	115W 57% (1)11/32"	170W 63% (1)1/4"	350W 65% (1)5/32"	520W 64% (1)3/16"	20W 30%	60W 44%	95W 47%	130W 48%	260W 48%	400W 49%		
20	65W 72% (1)7/16"	120W 67% (1)3/8"	170W 63% (1)11/32"	240W 67% (1)5/16"	480W 67% (1)1/4"	700W 65% (1)7/32"	30W 33%	80W 44%	130W 48%	200W 56%	400W 56%	550W 51%		
30	100W 74% (2)3/8"	175W 65% (1)7/16"	270W 67% (1)13/32"	360W 67% (1)3/8"	675W 63% (1)5/16"	1000W 62% (1)5/16"	50W 37%	125W 46%	210W 52%	290W 54%	580W 54%	850W 52%		
50	150W 67% (3)13/32"	310W 69% (2)7/16"	450W 67% (2)3/8"	620W 69% (2)11/32"	1100W 61% (1)7/16"	1500W 56% (1)3/8"	115W 51%	230W 51%	350W 52%	500W 56%	950W 53%	1400W 52%		
100	300W 67% (4)1/2"	560W 62% (4)13/32"	850W 63% (3)7/16"	1100W 61% (3)13/32"	1500W 42% (2)7/16"	-	200W 44%	425W 47%	625W 46%	850W 47%	1500W 42%	-		
200	-	725W 40% (4)5/8"	1050W 39% (4)9/16"	1300W 36% (4)1/2"	-	-	-	520W 29%	850W 31%	1300W 36%	-	-		
	1 NOZZLE BEST						2 NOZZLES BEST							

