

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

A. GENERAL INFORMATION

Permit No: 98-8085

Exam Date: 07/15/2025

1. Current Owner:
KENDALL D BODKIN AND DONNA K BODKIN LIVING TRUST 738 COPPER FALLS RD BONNERS FERRY
ID 83805-2407

2. Accompanied by: Kendall Bodkin
Phone No: 208-659-4043
Address: Same as above
Relationship to permit Holder: Permit holder - Trustee

3. **SOURCE:**
UNNAMED STREAM

Tributary
SINKS

Method of Determination: ArcMap and DRG Layer.

B. OVERLAP REVIEW

1. Other water rights with the same place of use: YES Overlap

Water Right No.	Source	Purpose of Use	Basis
98-7998	Unnamed Stream	Power	License

Comments: Licensed Right 98-7998 is owned by the Permit Holder and uses the same hydropower system as this Permit. During licensing process for 98-7998 Department staff validated the diversion rate as system developed was larger than what Permit 98-7998 authorized, which resulted in this current Permit 98-8085 filing. Condition X35 was added to the permit approval for 98-8085 based on combined diversion rate allowance; following the field exam for 98-8085 I evaluated the prior WR for overlap concern and have mitigated concerns by reducing the maximum diversion rate the system produces by the prior water right diversion rate amount to eliminate stacking of water rights. This results in two Power WRs with separate priority, separate diversion rate and separate diversion volume (non-consumptive) which are not considered overlapping in regard to conditions of approval (X35). I removed X35 from 98-8085 during licensing review.

2. Other water rights with the same point-of-diversion: YES Overlap

Water Right No.	Source	Purpose of Use	Basis
98-7998	Unnamed Stream	Power	License

Comments: Prior WR 98-7998 and this Permit shares the same POD; condition F06 was added to this Permit during the approval process, and it shall be carried forward to licensing for 98-8085. The Power system as developed has a diversion rate equal to 0.15 cfs (66 gpm). Prior WR 98-7998 accounts for 0.10 cfs and I've recommended licensing 98-8085's Power beneficial use (BU) with a diversion rate of 0.05 cfs. Based on this practice the Power BU water rights are not stacked as each retains separate priority and non-additive diversion rates for licensing purposes.

C. DIVERSION AND DELIVERY SYSTEM1. **LOCATION OF POINT(S) OF DIVERSION:**

UNNAMED STREAM SE¼ NE¼, Sec. 23, Twp 65N, Rge 02E, B.M. BOUNDARY County

Method of Determination: GPS. POD is a 6-inch short segment of pipe in-stream directing flow to a screened metal collection box (penstock inflow) to 4-inch PVC penstock pipeline located at -116° 09.6251, 48°58.3847.

PLACE OF USE: IRRIGATION

Twp	Rng	Sec	NE				NW				SW				SE				Totals
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
65N	02E	23			0.4					0.6									1.0

Total Acres: 1.0

PLACE OF USE: POWER

Twp	Rng	Sec	NE				NW				SW				SE				Totals
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
65N	02E	23			X														

Method of Determination: Beneficial use field examination and Arcmap aerial imagery.

3.

X Delivery System Diagram Attached (required). Indicate all major components and distances between components. Indicate weir size/pipe as applicable.

X Map Attached Showing Location(s) of point(s) of diversion and place(s) of use (required). Scale must be 1:24,000 or greater.

X Aerial Photo Attached (required for irrigation of 10+ acres).

X Photo of Diversion and System Attached

4.

Well or Diversion ID No.*	Motor Make	Hp	Motor Serial No.	Pump Make	Pump Serial No. or Discharge Size
UNNAMED STREAM	GRAVITY FLOW				

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date
NONE						

2. Measurements: I was unable to perform flow measurements due to inadequate pipe requirements. I utilized prior Water Right 98-7998 beneficial use report data and hydropower system specifications to evaluate pass through flow for the four (4) nozzles installed on the Harris LV1500 power unit to derive a flow rate equal to 66.4 gpm or 0.15 cfs.

E. FLOW CALCULATIONS

X Additional Computation Sheets Attached

Measured Method:

- Manufacturer performance specifications identify the following flow (worksheet attached)
 - 4ea ¼-inch nozzles, 75 PSI, 181ft head = $16.6 \times 4 = 66.4 \text{ gpm} = 0.15 \text{ cfs}$
- Permit authorized diversion rates: 0.17 cfs for Power BU; 0.06 cfs for Irrigation BU (based on 2.0 acres); maximum diversion rate = 0.20 cfs.
- Prior Right 98-7998 authorized maximum diversion rate = 0.10 cfs for Power BU.
- Recommended diversion rates for licensing purposes Permit 98-8085:
 - Irrigation BU: 1.0 ac validated at time of exam $\times 0.03 \text{ cfs per ac} = \mathbf{0.03 \text{ cfs}}$.
 - Power BU: 0.15 cfs (based on 181 ft head, 75 psi, 4ea ¼-inch nozzles) – 0.10 cfs (authorized by 98-7998) = $\mathbf{0.05 \text{ cfs}}$.
- Maximum diversion rate = the sum of two BUs = $\mathbf{0.08 \text{ cfs}}$.

F. VOLUME CALCULATIONS

1. Volume Calculations for irrigation:

$$V_{I.R.} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) = 1.0 \text{ ac} \times 3.0 \text{ afa} = 3.0 \text{ af}$$

$$V_{D.R.} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation season}) \times 1.9835 = 0.03 \text{ cfs} \times 214\text{-day} \times 1.9835 = 12.7$$

$$V = \text{Smaller of } V_{I.R.} \text{ and } V_{D.R.} = 3.0 \text{ af}$$

2. Volume Calculations for Other Uses:

- The irrigation beneficial use from the Unnamed Stream water source is exempt from the volume reporting requirements in accordance with IDAPA 37.03.02, Section 035.
- Power annual volume = $0.05 \text{ cfs} \times 24\text{hr}/7\text{day per week} \times 365 \text{ days per year} = \mathbf{36.2 \text{ af}}$ (non-consumptive water use)

The Permit Holder's Power system is authorized a total diversion rate of 0.15 cfs and 109 af when considering Rights 98-7998 & 98-8085, but there is no combined use conditions recommended for licensing purposes as the values have been separated in licensing recommendation for 98-8085.

G. NARRATIVE/REMARKS/COMMENTS

Field exam performed on 7/15/2025 with the applicant, Kendall Bodkin, showed a micro hydropower system that used water from an unnamed stream and irrigation use from the same diverting system. At the POD, the stream water is captured in a screened metal collection box situated in the low point of the stream. The penstock incorporates a 4-inch run of poly pipe that has 181 feet of head before reaching the power station at the POU. There is a manual shutoff valve installed on the penstock inflow pipe enabling the Permit Holder to turn off diversion as necessary at the POD for maintenance/clean-out of system infrastructure.

Power BU: The 4-inch PVC pipeline (penstock) daylights within the small hydropower station and immediately tees to 4ea nozzle supply hoses; I was unable to perform an ultrasonic flowmeter measurement due to inadequate pipe requirements. This Permit was necessitated by the Permit Holder's enlargement of prior Right 98-7998, which didn't authorize sufficient diversion rate for how the system was developed. I reviewed the beneficial use report for 98-7998 coupled with system data supplied by Mr. Bodkin at time of Statement of Completion and Harris micro-hydro system capacity charts to derive the flow rate (diversion rate) for licensing purposes.

- Prior Right 98-7998 had 1ea 3/16" nozzle and 3ea 1/4" nozzles operating at 80 PSI which passed 57.41 gpm or 0.13 cfs at time of exam on 3/18/2022.
- Current power system has 4ea 1/4" nozzles installed with a validated 75 PSI operating pressure. Mr. Bodkin's production data sheet asserted "approximately 16.1 GPM per nozzle" from the turbine at 80 PSI.
- Based on system capacity using 181 ft of head and 75 PSI operating pressure, I derived a 16.6 gpm per nozzle flow rate equaling 66.4 gpm total pass-through water being returned via an overflow discharge pipe from power unit.

Mr. Bodkin had submitted a support document with his Statement of Completion (see backfile) with historic calculations for June 2022 – June 2024 based on 25 amps / 1200 watts, 16.1 gpm, 80 PSI, and 26.9 approximate amps. These values are slightly lower than what I observed during the field exam, specifically the 30 amps I observed being produced at 75 PSI. This indicates the system may produce larger power output at the unit but there may be some minor line loss in transmission to battery bank(s) to power output on the service connection side of the system.

I've recommended licensing values based on Harris system capacity chart derived flow rates (see attached worksheets). Considering the total diversion rate of 66.4 gpm = 0.15 cfs, I've deducted 0.10 cfs of rate which is accounted for on prior Right 98-7998. This enables me to recommend a Power diversion rate of **0.05 cfs** toward licensing 98-8085. The non-consumptive annual volume for Power BU is derived by $24\text{hr}/7\text{day}/365\text{day}$ power generation at a rate of 0.05 cfs = 0.05 cfs x 365-day x 1.9835 = **36.2 af** considering Department rounding standards.

Irrigation BU: The Permit authorized development of two PODs, with one being considered for development lower in the unnamed stream reach for irrigation purposes. Mr. Bodkin elected to forego the second POD and used the existing 4-inch penstock pipeline to create a gravity flow system which serves the irrigation component of the water system. Within the power station the main 4-inch with tee fittings and manual shutoff valves provide water to each hydropower nozzle. At the end of the pipeline a 5th manual shutoff valve was installed which then reduces to a filter and subsequently to a 1 ½-inch poly pipe irrigation trunk line which exits the structure and routes to the irrigation POU. The pipeline is buried and there are 5ea stub lines of the truck pipeline with frost-free hydrant irrigation risers at intervals used for irrigation purposes.

I have removed the 2nd POD designated by permit in the SW¼NE¼ since it was not developed under this Permit's development period. I Have updated the Irrigation season of use to reflect 4/15 to 10/31, which is consistent with Department standards; no amendment to license is required for this clarification.

During the exam I used field maps to sketch the irrigation POU and collected photographs to illustrate the irrigation practices as developed. Mr. Bodkin asserts power generation is the priority for the combined system as it is their only source of electricity on the property, but in the summer when the battery banks are fully charged, he does rotate water to irrigate lawn and a fenced garden area. During licensing review, I used ArcMap aerial imagery to accurately trace out the irrigation POU, which equals 1.0 acres. The Permit authorized development of up to 2.0 acres with a corresponding diversion rate of 0.06 cfs. I have recommended licensing for irrigation with a reduced diversion rate to **0.03 cfs** which aligns with the Department's authorized 0.03 cfs per acre limit for diverting rates.

The gravity flow pipeline is more than adequate to provide the 0.03 cfs, to the point that the irrigation system is limited to operating a single sprinkler by hose and impact sprinkler while using soaker hoses on the fenced garden area without exceeding 0.03 cfs. Due to the surface water source supplying irrigation water, the BU is exempt from volume reporting on the face of the license but is captured by condition of approval limiting the irrigation to 0.03 cfs and 3.0 acre-feet annually.

During licensing review, I changed several conditions of approval as follows:

- Revised condition 916 to adapt language from Permit-to-License verbiage
- I removed conditions 236 and 932 based on compliance from Permit Holder.
- I removed conditions 01N and 08A which are not required on the license product based on database description notes.
- I replaced condition 17H with R22 transitioning from Permit-to-License.
- I have removed condition X35; I have un-stacked Power BU diversion rate overlap to mitigate combined use concerns and the condition is not necessary for licensing.
- I have added condition 027 to describe that the Power system water use is non-consumptive, as it routes directly back to the stream. The irrigation diverted water is consumptive in nature.

All other conditions on the Permit shall be carried forward to the license. Aside from the overlapping water rights described on PG1 of this report, which have been mitigated to negate stacking of Rights, there are no additional overlapping water right concerns toward licensing 98-8085.

Have conditions of permit approval been met? X Yes No

H. RECOMMENDATIONS

1. Recommended Amounts

<u>Beneficial Use</u>	<u>Period of Use</u>	<u>Rate of Diversion</u>	<u>Annual Volume</u>
IRRIGATION	04/15 to 10/31	0.03 CFS	
POWER	01/01 to 12/31	0.05 CFS	36.2 AF

Totals: 0.08 CFS

2. Recommended Amendments

Change P.D. as reflected above Add P.D. as reflected above X None

Change P.U. as reflected above Add P.U. as reflected above X None

I. AUTHENTICATION

Luke Bates – Sr Water Resource Agent

Field Examiner's Name



Date

7-24-2025

Reviewer



Date

7.7.26

State of Idaho
Department of Water Resources
Attachment to Field Exam
98-8085

This map depicts the POWER system diagram.



0 0.035 0.07 0.14 Miles

- Place Of Use Boundary
- Point of Diversion
- Townships
- PLS Sections
- Quarter Quarters



State of Idaho
Department of Water Resources
Attachment to Field Exam
98-8085

This map depicts the IRRIGATION system diagram.



0 0.05 0.1 0.2 Miles

-  Place Of Use Boundary
-  Point of Diversion
-  Townships
-  PLS Sections
-  Quarter Quarters



How much power can you generate with a hydroelectric turbine?

The amount of power available depends on the dynamic head, the amount of water flow and the efficiency of the turbine generator combination. To get an idea about available power in watts, multiply the head in feet, times flow in gallons per minute, times 0.18, times turbine efficiency. Turbine efficiency ranges from 35% to 70%, with higher efficiency at higher heads. To get a rough idea, use 0.40 (representing 40%) as a multiplier for efficiency. The Harris Pelton turbines are well suited to higher head and lower flow situations. Flow is limited by nozzle size (a maximum 1/2"). Harris turbines are now available with permanent magnet (PM) alternators providing up to 50% efficiency. Higher flows are accommodated by the ESD Turgo Turbines. They can have nozzles of up to 1" diameter, and provide better efficiency at low heads. The HI-Power

Hydros are ideal for sites where water is available at long distances from power needs. They generate 100+ volts AC that is stepped down and rectified at the batteries. This allows the use of relatively small wire for a distance of up to 10,000 feet. Transmitting the power from the generator to the battery at twice the battery voltage allows you to use 1/4 of the wire size for the same power loss. At 4 times the battery voltage, you can use 1/16 of the wire size required to transmit power at the battery voltage. The HI-Power hydroelectric generator can also deliver up to 3600 watts where higher power is needed. The LV Hydroelectric Generator and the ES&D Water Baby are a good solution for very low flow situations where the head is high enough to make some power.

Pipelines

A hydroelectric turbine operates from the pressure at the bottom end of a pipeline. This pressure, usually measured in pounds per square inch (psi), is directly related to the head, the vertical drop from the top of the pipeline where the water goes into the turbine located at the bottom of the pipeline. The pressure at the lowest point of a pipeline is equal to 0.433 times the head, (the vertical distance in feet).

Pressure is important because it is a determining factor in how much power is available and what type of pipe is required. Polyethylene pipe can be used for pressures up to 100 psi, PVC pipe is available with pressure ratings from 160 to 350 psi and steel pipe can withstand 1000 psi or more. Check with your local plumbing supplier for pipe ratings. Pipe diameter is very important. All pipelines will cause the water flowing in them to lose some energy to friction. The pipe must be large enough for the maximum quantity of water it will carry.

The pressure at the bottom of a pipeline when water is not flowing is called static pressure. When water is flowing through the outlet or nozzle of the hydroelectric turbine, the pressure at the outlet is the dynamic pressure or running head. If you install a gate valve on the pipeline just above the turbine and a pressure gauge on a "T" fitting just above the gate valve, you will read the static pressure on the gauge when the valve is closed and the dynamic pressure when the valve is opened. The maximum power that can be delivered by a pipeline will occur when the dynamic pressure is approximately 2/3 of the static pressure.

The actual flow rate of the water in a hydroelectric system is determined by the diameter of the nozzle. We will supply a turbine with the proper size nozzle for your site, depending on the head, flow, length and diameter of the pipe. We carry hydroelectric generators made by Energy Systems and Design, HI-Power Hydroelectric, and Harris Hydroelectric. Use the descriptions on the following pages to help determine which turbine will work best for your site and power requirements.

$$\text{Head} - \text{Friction Loss} \times \text{Flow} \times \text{Factor} \times \text{Efficiency} = 1394 \text{ watts peak}$$

$(181 - 0.52) \times (66 \text{ gpm}) \times 0.18 \times 0.65$

Hydroelectric Power Output Estimation Formula:

Dynamic Head (ft) x Flow (GPM) x 0.18 x Turbine Efficiency (use 0.40) = Output Watts

We can help you design your system

If you think you have a suitable site, contact us and we will help you choose the best unit for your situation. Please provide the following information about your site:

1. **Head** – The total vertical elevation from the place where the water enters the pipe to the point where the turbine will be located.
2. **Flow** – The number of gallons per minute that are available.
3. **Distance** – The length of pipe that will be necessary to carry the water from the pickup to the turbine. If the pipe is already installed, what is the type and diameter?
4. **Location** – Distance from turbine to batteries.

Nozzle selection

Power output of a hydroelectric generator is determined by the pressure of the water at the nozzle and the amount of water flowing out of the nozzle. The larger the nozzle, the greater the flow will be. The nozzle must also be sized small enough to keep your pipeline full and keep the speed of the water in the pipe below 5 feet per second. The nozzle selection table on the next page shows water flow through various size nozzles at given pressures. Use this table to determine what size nozzle and how many nozzles you need to accommodate the flow of water you have and to deliver the amount of power you need. A pressure gauge in the pipe feeding your turbine, installed before the shutoff valve, can help you check proper operation and diagnose problems. When the valve is shut off, the gauge will read the static pressure in pounds per square inch psi (head in feet x 0.433). When the valve is turned on the gauge will read a lower (dynamic) pressure.

The difference between these two pressures represents your loss to friction in the pipe. The greater the flow, the greater your loss will be. (See PVC pipe loss table on the next page.)

$$\sim 3 \text{ gph at } 48 \text{ V} = 1440 \text{ Wh}$$

* System is highly efficient.

Water Flow Information for Pumping and Hydroelectric Design

Flow Through Nozzles

The table below shows the flow in gallons per minute (gpm) through various diameter nozzles at a range of heads from 5 feet to 400 feet. Use table to choose what nozzle size to use and how many nozzles a turbine must have to give the required flow to use all of the water available in the system.

181 ft Head.

4 ea 1/4" nozzles Installed

75 PSI operating Pressure

Head		Flow in gpm through these nozzle diameters:											Rpm for 4" turbine
feet	psi	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"	1.0"	
5	2.2	-	-	-	-	6.18	8.4	11	17.1	24.7	33.6	43.9	460
10	4.3	-	-	3.88	6.05	8.75	11.6	15.6	24.2	35	47.6	62.1	650
15	6.5	-	2.68	4.76	7.4	10.7	14.6	19	29.7	42.8	58.2	76	800
20	8.7	1.37	3.09	5.49	8.56	12.4	16.8	22	34.3	49.4	67.3	87.8	925
30	13	1.68	3.78	6.72	10.5	15.1	20.6	26.9	42	60.5	82.4	107	1140
40	17.3	1.94	4.37	7.76	12.1	17.5	23.8	31.1	48.5	69.9	95.1	124	1310
50	21.7	2.17	4.88	8.68	13.6	19.5	26.6	34.7	54.3	78.1	106	139	1470
60	26	2.38	5.35	9.51	14.8	21.4	29.1	38	59.4	85.6	117	152	1600
80	34.6	2.75	6.18	11	17.1	24.7	33.6	43.9	68.6	98.8	135	176	1850
100	43.3	3.07	6.91	12.3	19.2	27.6	36.6	49.1	76.7	111	150	196	2070
120	52	3.36	7.56	13.4	21	30.3	41.2	53.8	84.1	121	165	215	2270
150	65	3.76	8.95	15	23.5	33.8	46	60.1	93.9	135	184	241	2540
200	86.5	4.34	9.77	17.4	27.1	39.1	53.2	69.4	109	156	213	278	2930
250	108	4.86	10.9	19.9	30.3	43.6	59.4	77.6	121	175	238	311	3270
300	130	5.32	12	21.3	33.2	47.8	65.1	85.1	133	191	261	340	3590
400	173	6.14	13.8	24.5	38.3	55.2	75.2	98.2	154	221	301	393	4140

→ 181 ft

75 PSI

~16.5 gpm

PVC Pipe Loss Table

$$16.5 \text{ gpm} \times 4 \text{ ea } 1/4" \text{ nozzles} = 66 \text{ gpm} = 0.15 \text{ cfs}$$

Use the table below to determine what pipe size is required to efficiently allow necessary flow for your power need. Once you know the required flow for your system (gpm), find the head loss for various pipe sizes. Multiply the head loss number by the length of the pipe divided by 100 and you will get the loss of head for that pipe size. The actual head minus the head loss will give you the effective dynamic head in the system.

Pipe Friction Loss Table – Head Loss in Feet per 100 Feet of Schedule 40 PVC Pipe																								
		Flow (gallons per minute)																						
		1	2	3	4	5	7	10	15	20	25	30	40	50	60	70	80	100	150	200	250	300	400	500
Pipe diameter (inches)	1/2	2.08	4.16	8.7	14.8	23.5	43																	
	3/4	0.51	1.02	2.2	3.7	5.73	10.5	20.1	42.5															
	1	0.1	0.55	0.68	1.15	1.72	3.17	6.02	12.8	21.8	32.9	46.1												
	1-1/4	0.03	0.14	0.19	0.31	0.44	0.81	1.55	3.28	5.59	8.45	11.9	22	30.5	45.6									
	1-1/2		0.07	0.08	0.13	0.22	0.38	0.72	1.53	2.61	3.95	5.53	9.43	14.3	20	28.6	36.7							
	2			0.03	0.05	0.07	0.11	0.21	0.45	0.76	1.15	1.62	2.75	4.16	5.84	7.76	9.94	15.1	34.8	59.3				
	2-1/2				0.03	0.04	0.05	0.09	0.19	0.32	0.49	0.68	1.16	1.75	2.46	3.27	4.19	6.33	13.4	25.0	37.8	46.1		
	3						0.02	0.03	0.07	0.11	0.17	0.23	0.4	0.6	0.85	1.13	1.44	2.18	4.63	7.88	11.9	18.4	40.1	
4										0.04	0.06	0.11	0.16	0.22	0.3	0.38	0.58	1.22	2.08	3.15	4.41	7.52		
5											0.03	0.04	0.05	0.07	0.1	0.13	0.19	0.4	0.69	1.05	1.46	2.49	3.76	
6													0.02	0.03	0.04	0.05	0.08	0.16	0.28	0.43	0.6	1.01	1.53	

0.26 per 100

~ 0.52 gpm Friction Loss

HI-Power

Low-Voltage LV Hydroelectric Generators

HI-Power is now offering a low-voltage brushless PM generator. This user-friendly unit requires no adjustments and is more efficient than car alternator types over a wider range of head and flow.

- Head range: 40 to 400 feet
- Flow range: 5 to 400 gpm
- Maximum power: 1200 watts
- Efficiency: 30% to 70%
- Battery voltage options: 12V, 24V, 48V, 96V

Available in the four voltages above for direct battery charging. The 48- and 96-volt units allow the use of smaller gauge wire between the generator and the battery. An MPPT charge control, like the OutBack MX-60, can be used to efficiently step the voltage down for charging and regulating 12-, 24- or 48-volt batteries.

The sealed permanent magnet alternator is mounted on a Harris housing with the bronze Harris Pelton wheel. The external rectifier is water-cooled and all fasteners are stainless steel. It comes with an induction meter and 3 feet of 1" flexible hose per nozzle.

Order multiple nozzles for convenient adjustment to varying flows. Alternator has 2 sealed 6203 bearings which should be changed every 5-10 years, depending on use. When ordering, specify battery voltage, transmission line length and size, flow, pressure, pipe size and length.



Description	Item code	Price
LV Hydro with 1 nozzle	017-02005	\$1,350
LV Hydro with 2 nozzles	017-02007	\$1,400
LV Hydro with 3 nozzles	017-02009	\$1,450
* LV Hydro with 4 nozzles	017-02011	\$1,500
Car alternator upgrade kit for older Harris Hydroelectric units with brush type alternators	017-02039	\$500

Higher Voltage HV Hydroelectric Generators

HI Power Hydroelectric generators are ideal for sites where water is far from power needs (up to 10,000 feet) or when greater power is required. High transmission voltage can be sent over a mile before being 'stepped down' to battery voltage. It comes complete with step-down transformer, rectifier, fuses and amp meter. Use a diversion-type regulator with these units.

- Head range: 60 to 500 feet
- Flow range: 10 to 400 gpm
- Maximum power: 3600 watts
- Efficiency: 30% to 60%
- Transmission voltage: 110V to 440V
- Battery voltage: 12V, 24V, 48V

These hydroelectric generators use brushless alternators for reliability and versatility. They produce 110V, 220V, or 440V "wild" (unregulated) AC, which is then stepped down with the supplied transformer and rectifier.

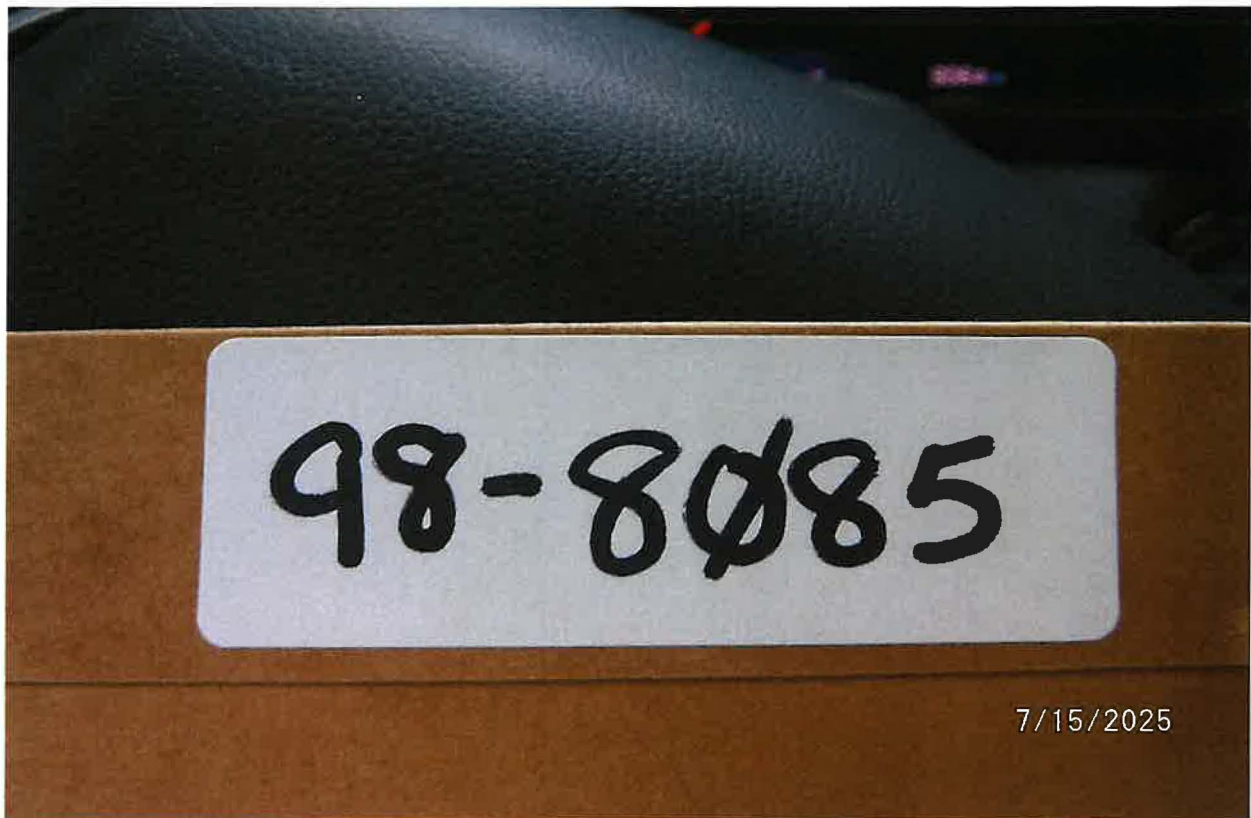
The heavy-duty brushless alternator is housed on the Harris housing and uses the Harris Bronze Pelton Wheel for flows up to 200 gpm and the ESD Turgo Wheel and housing for flows of 200 to 400 gpm. Available in 4 sizes ranging from 600 to 3600 watts. The HV600 is available with 2 or 4 nozzles. The larger units come with 4 nozzles.

2-year warranty. Specify battery voltage when ordering.



Description	Item code	Price
HV 1200 – 1200 watt 4 nozzle	017-02030	\$3,600
HV 1800 – 1800 watt 4 nozzle	017-02031	\$4,200
HV 3600 – 3600 watt 4 nozzle	017-02034	\$6,000
Hi-Power turgo nozzle	017-02037	\$600

Harris Hi-power LV 1500 (48V) with 4 nozzles installed.



BENEFICIAL USE FIELD EXAM DATE 7/15/2025



POD – 4-INCH PIPELINE PENSTOCK IN CREEK GRAVITY FLOWS WITH 181 FT OF HEAD

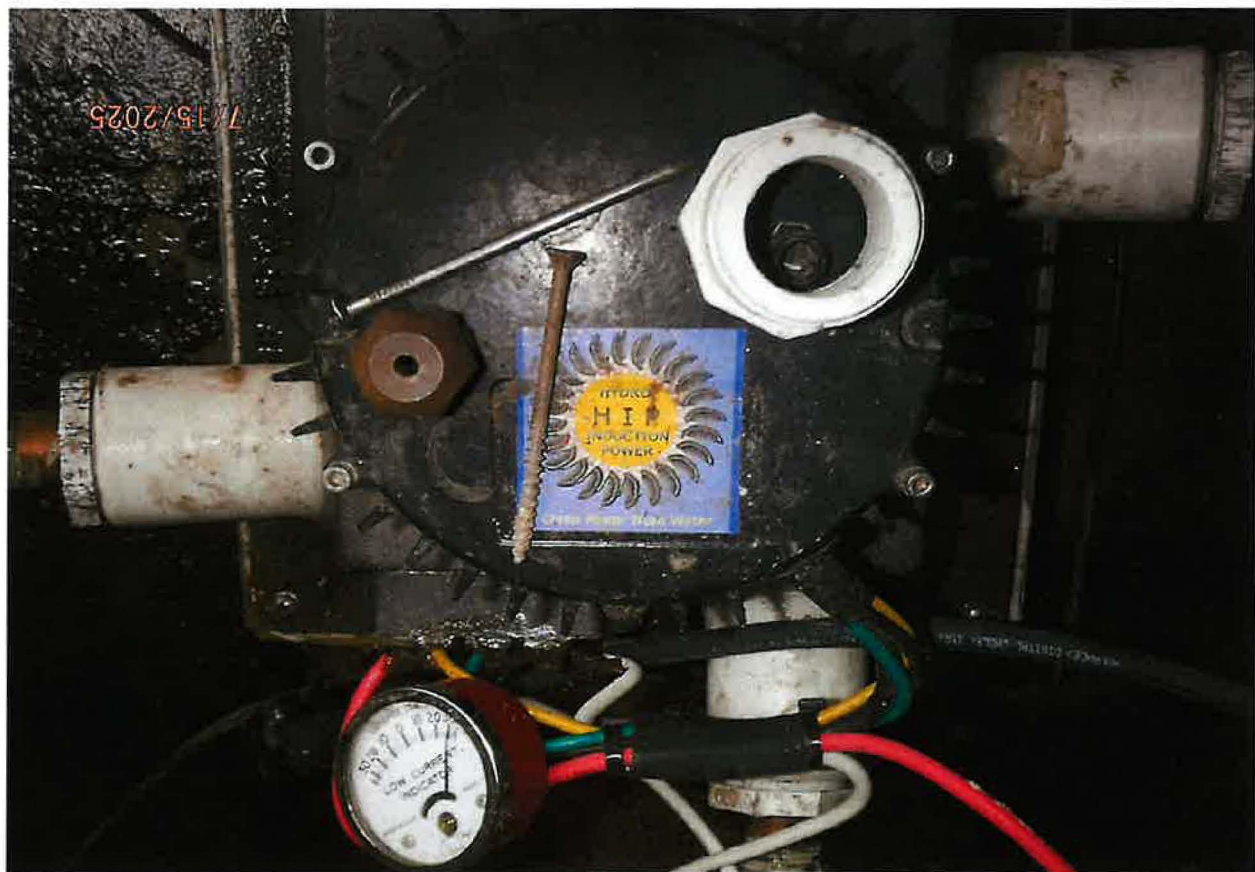


POD – 4-INCH PIPE IN CREEK ROUTES TO PENSTOCK THROUGH A SCREENED
INFLOW COLLECTION PLATE

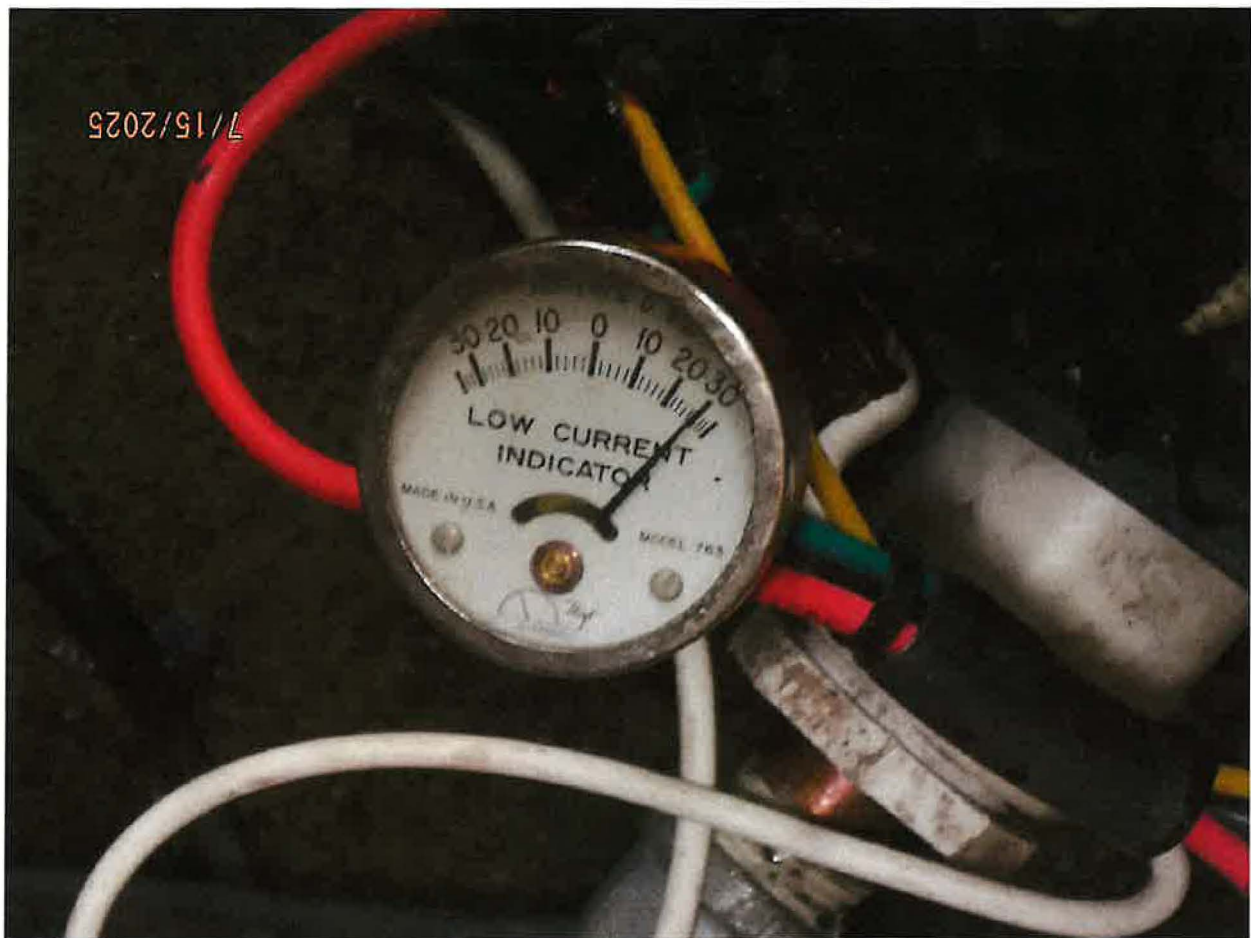




POU – MICRO POWER STATION; INFLOW FROM PENSTOCK ON L/H WITH 4EA NOZZLE STEM PIPES ATTACHED TO POWER UNIT



HYDRO POWER UNIT WITH 4 HEADS OPERATING 24/7, 365 DAYS A YEAR.



POU – 4EA ¼-INCH NOZZLES PRODUCING 30 AMPS (48 VOLT SYSTEM)



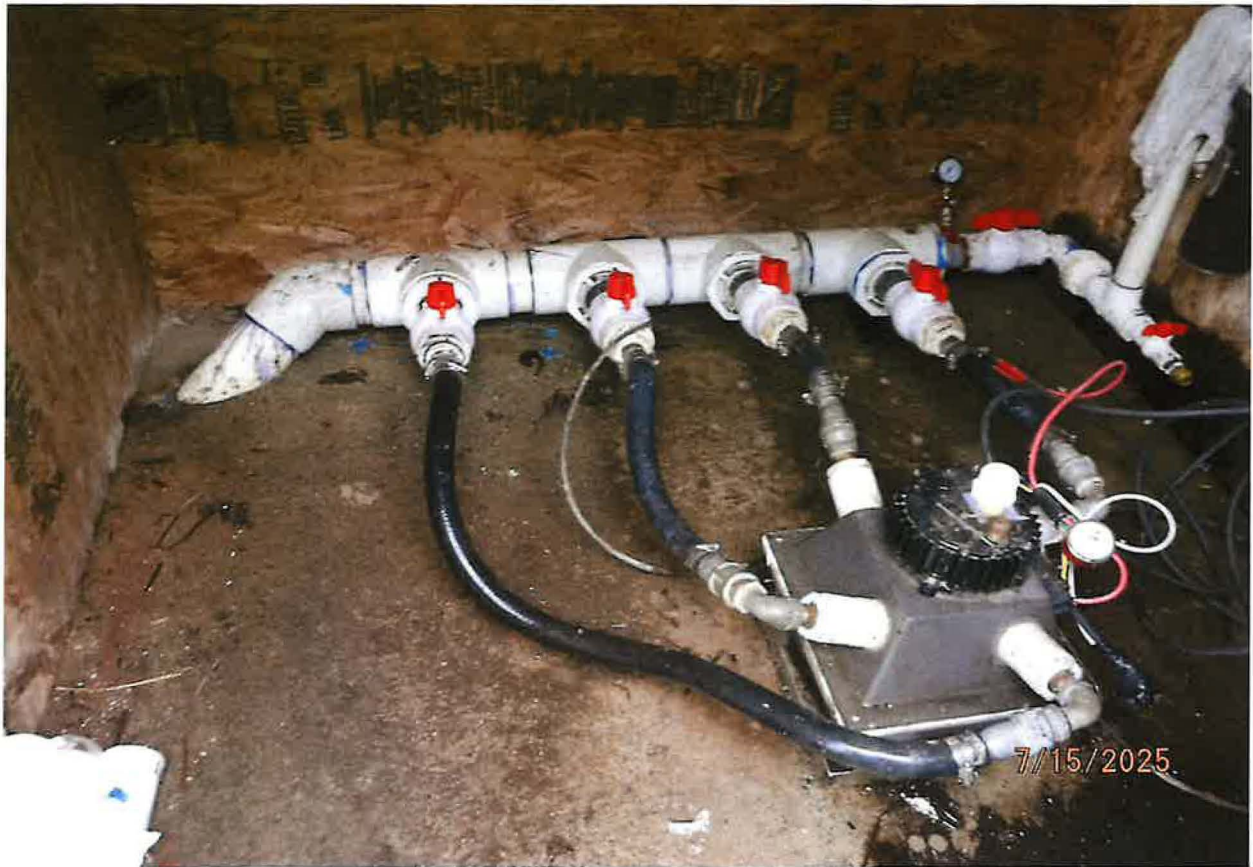
POU – POWER SYSTEM OPERATING AT 75 PSI AT TIME OF EXAM



POU – POWER SYSTEM OVERFLOW DISCHARGE THROUGH 4EA 1/4-INCH NOZZLES AND MICRO HYDRO UNIT RETURN TO UNNAMED STREAM (NON-CONSUMPTIVE USE)



UNNAMED STREAM FLOWS FROM LEFT TO RIGHT IN IMAGE WITH OVERFLOW FROM POWER RETURNING TO STREAM



R/H SIDE OF IMAGE – PENSTOCK TO POWER CAN BE CYCLED OFF (RED VALVES) OR THE IRRIGATION RISER PIPE (RED SHUTOFF VALVE DOWN STREAM OF PRESSURE GAGUE CAN BE TURNED ON TO ALLOW IRRIGATION WATER USE FROM PENSTOCK



OUTFLOW FROM IRRIGATION SERVICE PIPE VAVLE ROUTES OUT OF POWER STATION TO MULTIPLE FROST-FREE HYDRANTS



IRRIGATION POU – CONVEYANCE PIPE IS A 1 ½-INCH POLY PIPE RUN WITH LATERAL IRRIGATION STUBS TO FROST-FREE HYDRANT(S) WITH IRRIGATION BY HOSE AND SPRINKLER



IRRIGATION POU



IRRIGATION POU



IRRIGATION POU – LAWN FROM SURFACE SOURCE AND FLOWER WATERING FROM SEPARATE GROUND WATER WELL SYSTEM



IRRIGATION POU



IRRIGATION POU – FENCED GARDEN AND LAST FROST FREE HYDRANT ON IRRIGATION PIPELINE. MOWED GRASS AREA AROUND FENCED GARDEN IS NOT IRRIGATED, RATHER A NATURALLY WET LAND AREA



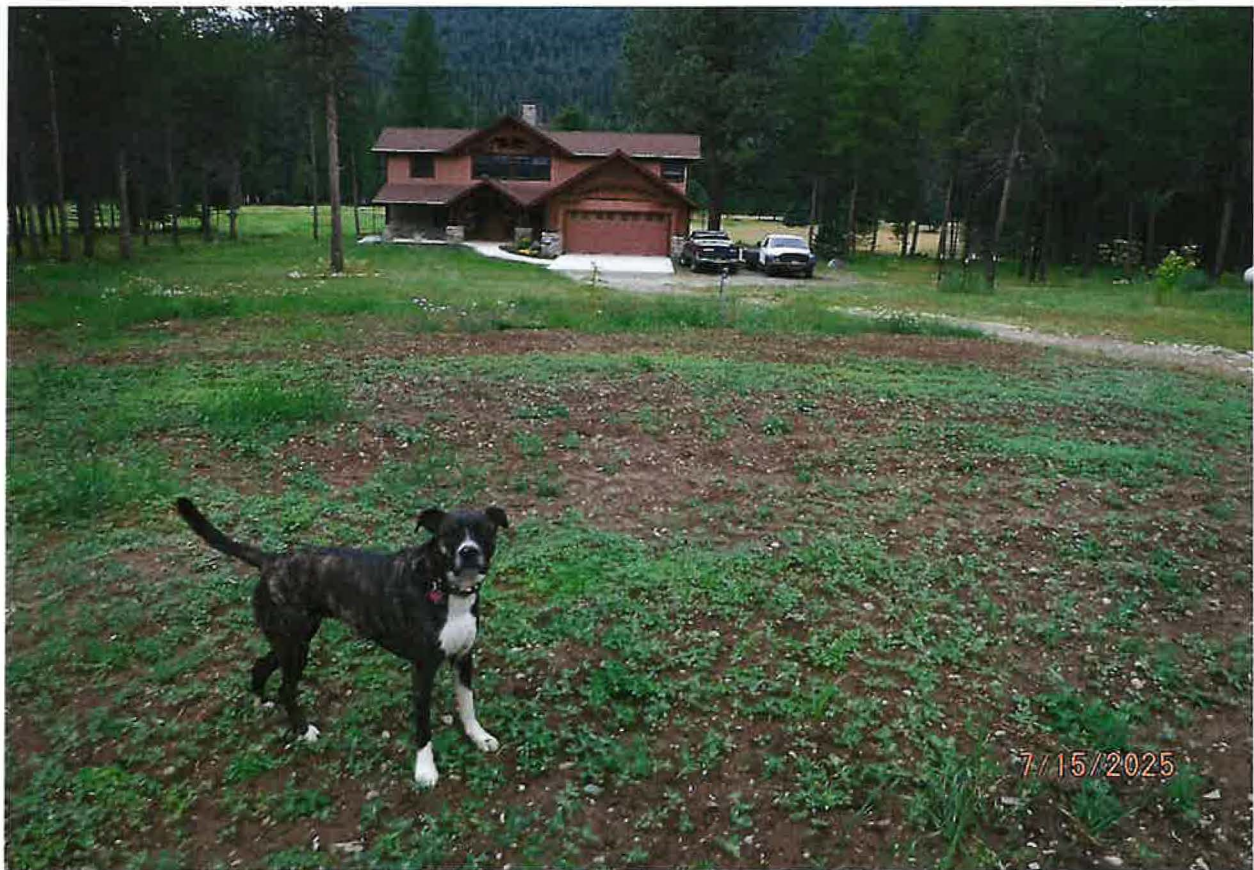
IRRIGATION POU – FENCED GARDEN AREA



IRRIGATION POU – LAWN SPACE AROUND RESIDENCE



IRRIGATION POU – LAWN SPACE AROUND RESIDENCE WATERED BY HOSE AND SPRINKLER



IRRIGATION POU