



State of Idaho

DEPARTMENT OF WATER RESOURCES

322 East Front Street • P.O. Box 83720 • Boise, Idaho 83720-0098

Phone: (208) 287-4800 • Fax: (208) 287-6700 • Website: www.idwr.idaho.gov

C.L. "BUTCH" OTTER
Governor

GARY SPACKMAN
Director

September 12, 2013

ROBERT TIMMONS
74 E VALLEY VIEW DR
PRESTON ID 83263

BARBARA SENTER
14562 N HWY 34
THATCHER ID 83283

RE: License No. 13-7577

Issuance of License

Dear Water Right Holder(s):

The Department of Water Resources has issued the enclosed Water Right License confirming that a water right has been established in accordance with your permit. Please be sure to thoroughly review the conditions of approval and remarks listed on your license.

The license is a PRELIMINARY ORDER issued by the Department pursuant to section 67-5243, Idaho Code. It can and will become a final order without further action by the Department unless a party petitions for reconsideration or files an exception and/or brief within fourteen (14) days of the service date as described in the enclosed information sheet.

Please note that water right owners are required to report any change of water right ownership and/or mailing address to the Department within 120 days of the change. Failure to report these changes could result in a \$100 late filing fee. Contact any office of the Department or visit the Department's homepage on the Internet to obtain the proper forms and instructions.

If you have any questions, please contact me at 208-287-4916.
Sincerely,

Craig L. Saxton
Water Rights Supervisor

Enclosure(s)

CERTIFICATE OF SERVICE

I hereby certify that on September 13, 2013, I mailed a true and correct copy, postage prepaid, of the foregoing PRELIMINARY ORDER (Approved License) to the person(s) listed below:

RE: WATER RIGHT NO.

13-7577

**BARBARA SENTER
14562 N HWY 34
THATCHER ID 83283**

**ROBERT TIMMONS
74 E VALLEY VIEW DR
PRESTON ID 83263**



**Darla Block
Technical Records Specialist**

EXPLANATORY INFORMATION TO ACCOMPANY A PRELIMINARY ORDER

(To be used in connection with actions when a hearing was not held)

(Required by Rule of Procedure 730.02)

The accompanying order or approved document is a "Preliminary Order" issued by the department pursuant to section 67-5243, Idaho Code. **It can and will become a final order without further action of the Department of Water Resources ("department") unless a party petitions for reconsideration, files an exception and brief, or requests a hearing as further described below:**

PETITION FOR RECONSIDERATION

Any party may file a petition for reconsideration of a preliminary order with the department within fourteen (14) days of the service date of this order. **Note: the petition must be received by the department within this fourteen (14) day period.** The department will act on a petition for reconsideration within twenty-one (21) days of its receipt, or the petition will be considered denied by operation of law. See Section 67-5243(3) Idaho Code.

EXCEPTIONS AND BRIEFS

Within fourteen (14) days after: (a) the service date of a preliminary order, (b) the service date of a denial of a petition for reconsideration from this preliminary order, or (c) the failure within twenty-one (21) days to grant or deny a petition for reconsideration from this preliminary order, any party may in writing support or take exceptions to any part of a preliminary order and may file briefs in support of the party's position on any issue in the proceeding with the Director. Otherwise, this preliminary order will become a final order of the agency.

REQUEST FOR HEARING

Unless a right to a hearing before the Department or the Water Resource Board is otherwise provided by statute, any person aggrieved by any final decision, determination, order or action of the Director of the Department and who has not previously been afforded an opportunity for a hearing on the matter may request a hearing pursuant to section 42-1701A(3), Idaho Code. A written petition contesting the action of the Director and requesting a hearing shall be filed within fifteen (15) days after receipt of the denial or conditional approval.

ORAL ARGUMENT

If the Director grants a petition to review the preliminary order, the Director shall allow all parties an opportunity to file briefs in support of or taking exceptions to the preliminary order and may schedule oral argument in the matter before issuing a final order. If oral arguments are to be heard, the Director will within a reasonable time period notify each party of the place, date and hour for the argument of the case. Unless the Director orders otherwise, all oral arguments will be heard in Boise, Idaho.

CERTIFICATE OF SERVICE

All exceptions, briefs, requests for oral argument and any other matters filed with the Director in connection with the preliminary order shall be served on all other parties to the proceedings in accordance with IDAPA Rules 37.01.01302 and 37.01.01303 (Rules of Procedure 302 and 303).

FINAL ORDER

The Director will issue a final order within fifty-six (56) days of receipt of the written briefs, oral argument or response to briefs, whichever is later, unless waived by the parties or for good cause shown. The Director may remand the matter for further evidentiary hearings if further factual development of the record is necessary before issuing a final order. The department will serve a copy of the final order on all parties of record.

Section 67-5246(5), Idaho Code, provides as follows:

Unless a different date is stated in a final order, the order is effective fourteen (14) days after its service date if a party has not filed a petition for reconsideration. If a party has filed a petition for reconsideration with the agency head, the final order becomes effective when:

- (a) The petition for reconsideration is disposed of; or
- (b) The petition is deemed denied because the agency head did not dispose of the petition within twenty-one (21) days.

APPEAL OF FINAL ORDER TO DISTRICT COURT

Pursuant to sections 67-5270 and 67-5272, Idaho Code, if this preliminary order becomes final, any party aggrieved by the final order or orders previously issued in this case may appeal the final order and all previously issued orders in this case to district court by filing a petition in the district court of the county in which:

- i. A hearing was held,
- ii. The final agency action was taken,
- iii. The party seeking review of the order resides, or
- iv. The real property or personal property that was the subject of the agency action is located.

The appeal must be filed within twenty-eight (28) days of this preliminary order becoming final. See section 67-5273, Idaho Code. The filing of an appeal to district court does not itself stay the effectiveness or enforcement of the order under appeal.

State of Idaho
Department of Water Resources
Water Right License

WATER RIGHT NO. 13-07577

Priority: November 04, 1999

Maximum Diversion Rate: 0.45 CFS

It is hereby certified that ROBERT TIMMONS
74 E VALLEY VIEW DR
PRESTON ID 83263

And

BARBARA SENTER
14562 N HWY 34
THATCHER ID 83283

has complied with the terms and conditions of the permit, issued pursuant to Application for Permit dated November 04, 1999; and has submitted Proof of Beneficial Use on January 08, 2001. An examination confirms water is diverted from:

SOURCE

MAPLE GROVE HOT SPRINGS

Tributary: BEAR RIVER

and a water right has been established as follows:

BENEFICIAL USE

POWER

PERIOD OF USE

1/01 to 12/31

DIVERSION RATE

0.45 CFS

LOCATION OF POINT(S) OF DIVERSION:

MAPLE GROVE HOT SPRINGS NE1/4SW1/4NE1/4 Sec. 7, Twp 13S, Rge 41E, B.M.
FRANKLIN County

PLACE OF USE: POWER

Twp	Rge	Sec	NE				NW				SW				SE				
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	Totals
13S	41E	7			X														

CONDITIONS OF APPROVAL

1. This right does not constitute Idaho Public Utilities Commission or Federal Energy Regulatory Commission approval that may be required.
2. Use of water under this right shall be non-consumptive.
3. The term of this right shall extend to 12/31/2019. Prior to the expiration of the term, the Director may issue an order canceling all or any part of the use authorized herein, may establish a new term, or may revise, delete, or add conditions under which the right may be exercised. The order shall take effect on the date the current term expires. If the director does not issue such an order, the term shall automatically extend to a length equal to the project's prior term and any prior conditions on the water right shall remain in effect.

State of Idaho
Department of Water Resources
Water Right License

WATER RIGHT NO. 13-07577

4. Use of water under this right will be regulated by a watermaster with responsibility for the distribution of water among appropriators within a water district. At the time of this approval, this water right is within State Water District No. 11.
5. The following rights are diverted through point(s) of diversion described above: 13-7577 and 13-7576.
6. The rights for the use of water confirmed in this license shall be junior and subordinate to all rights for the use of water other than hydropower, within the State of Idaho that are initiated later in time than the priority of this right and shall not give rise to any right or claim against any future rights for the use of water, other than hydropower, within the State of Idaho initiated later in time than the priority of this right.
7. Rights 13-7577 and 13-7576 when combined shall not exceed a total diversion rate of 0.80 cfs at the field headgate.

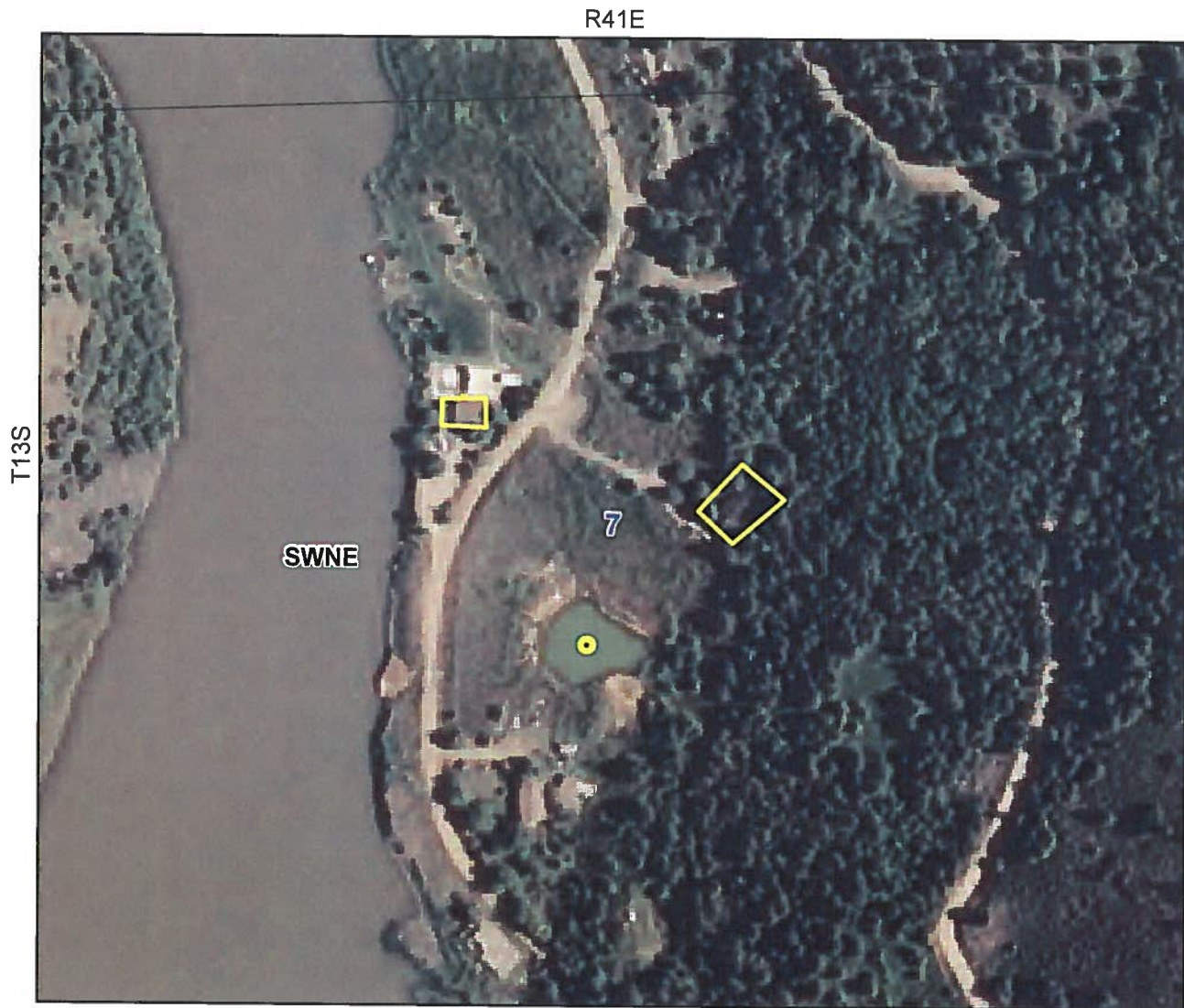
This license is issued pursuant to the provisions of Section 42-219, Idaho Code. The water right confirmed by this license is subject to all prior water rights and shall be used in accordance with Idaho law and applicable rules of the Department of Water Resources.

Signed this 12th day of September, 2013.


for GARY SPACKMAN
Director

State of Idaho
Department of Water Resources
Attachment To Water Right License
13-7577

This map depicts the POWER place of use boundary for this water right at the time of this approval and is attached to the approval document solely for illustrative purposes.



0 0.025 0.05 0.1 Miles

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



STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

A. GENERAL INFORMATION

Permit No: 13-7577

Exam Date: 1/8/2013

1. Current Owner: ROBERT TIMMONS
74 E VALLEY VIEW DR
PRESTON ID 83263
(208)851-1138

And

LOU CLAYTON
PO BOX 32
THATCHER ID 83283

2. This is an In-Office field examination, using notes and pictures for the field examination conducted 8/23/2012 on the same POD and distribution system for water right 13-7576 (Commercial use for 3 hot tubs and 1 pool, using the same flow thru system); emails from Barbara Senter (previously Barbara Timmons; present owner), and emails from the manufacture Energy Systems and Design Ltd. for the Pelton Wheel.

3. SOURCE

MAPLE GROVE HOT SPRINGS

TRIBUTARY

BEAR RIVER

B. OVERLAP REVIEW

1. Other water rights with the same place of use: 13-7135 Irrigation (unnamed stream); 13-7576 Commercial (from the same hot springs, for 3 hot tubs and 1 pool); 13-4347 domestic (a cold spring, for potable water, showers, restroom and kitchen).
2. Other water rights with the same point of diversion: 13-7576 Commercial (from the same hot springs pond)

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

MAPLE GROVE HOT SPRINGS NE1/4SW1/4NE1/4 Sec. 7, Twp 13S, Rge 41E, B.M. FRANKLIN County

Method of Determination: 2009 Arc Map, Bing Maps, maps from the 13-7576 field exam, and 12/27/2012 email and 1/3/2013 phone conversation with Barbara Senter (copy attached).

2.

PLACE OF USE: POWER

Twp	Rge	Sec	NE				NW				SW				SE				
			<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>NE</u>	<u>NW</u>	<u>SW</u>	<u>SE</u>	<u>Totals</u>
13S	41E	7			X														

Method of Determination: 2009 Arc Map, Bing Maps, maps from the 13-7576 field exam, and 12/27/2012 email and 1/3/2013 phone conversation with Barbara Senter (copy attached).

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 (copies from the Manufacture of a Pelton Wheel)

4.

Well or Diversion**ID No.*****Motor Make****Hp****Motor Serial No.****Pump Make****Pump Serial No. or Discharge Size**

This is a flow thru system, consisting of multiple springs forming a pond, a 6 inch discharge to 6 inch plastic pipe, thru a shut-off valve, continuing down and thru a 6 inch McCrometer propeller mechanical flowmeter serial no. 12-08338-06, model M306, continuing past the pool to 1 Stream Engine from New Brunswick Canada made by Energy Design 2 Pelton Wheel, with flow thru system continuing to the river.

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

D. FLOW MEASUREMENTS1. **Measurements:**

Theoretical: 6 inch pipe conversion = $5 \times 3.1416 \times (\text{diameter}/12)/2\text{squared} = 0.98 \text{ cfs}$

Physical Measurement:

8/23/2012 field exam for 13-7576 McCrometer Propeller mechanical flowmeter 12-08338-06, model M306 = 0.80 cfs

Using Electricity Demand Chart for known appliances (itemized sheet attached), then using Figure 1 Graphical Solution of Hydro Power Problems from (Appl. Memo 24 Amended):

13.984 kw at 50% efficiency (eff. Used for Pelton Wheels) = $H \times Q = 325$

If $H = 100'$ (to the business building); $325/100 = 3.25 \text{ cfs}$

If $H = 423'$ (to the house); $325/423 = 0.76 \text{ cfs}$

(as stated in Memo 24 Amended, there are an infinite number of possible solutions for $H \times Q = 325$, that produce 13.984 kw of power).

Energy Systems and Design Ltd., 1/9/2013 email, states that at this site, at least 500 watts could be generated, maybe more. This would use about 200 gpm for one machine, and more power could be generated with 2 machines. Since there is only one Pelton Wheel:

$200 \text{ gpm} \times 0.00223 = 0.446 = 0.45 \text{ cfs}$

RECOMMEND:

Power 0.45 cfs as permitted, with a combined limit with 13-7576 of 0.80 cfs (same water, same flow-through system back to the river)

F. VOLUME CALCULATIONS

1. Volume Calculations for Power:

No volume listed on license for non-consumptive power generation use.

G. NARRATIVE/REMARKS/COMMENTS

This is an In-Office field examination with information taken from the 8/23/2012 field examination conducted by Paul Scoresby, PE on water right 13-7596, plus emails from Barbara Senter and Energy Systems and Design Ltd.. Some background on the area, the first pool was built on the property around 1913 (from a journal of the homesteader's daughter). Nothing is stated as to when the business building and home were built. They run about \$8000 a month business, at \$8 each adult and some overnight stays, with between 800 - 1000 people per month. The system consists of a hot springs pond that has an overflow directly to the river on the west side, and on the north side a 6 inch discharge to 6 inch plastic pipe, a shut off valve, a 6 inch McCrometer propeller mechanical flowmeter 12-08338-06, model M306, with gravity flow that continues down past the pool, through the pelton wheel located north of the pool (near the solar panels) and then discharges to the river. There are (16) 6-volt deep cycle batteries for power storage. The Pelton wheel is a stream engine from Brunswick Canada, made by Energy Design 2. All power to the batteries is utilized. Some power is made by solar panels and windmill. Power is supplied to a 1400 sq ft house northwest of the hot springs pond located in the trees, and the 30 ft X 40 ft business building by the pool. Power is used for 2 refrigerators, a gas forced air furnace, a computer, a chest freezer, a microwave, lighting for both places, 2 pumps, 1 septic lift pump, phone booster equipment to get cellular reception, and small kitchen appliances if needed.

Ownership: At the time of the field examination, the water right permit was under the name of Robert Timmons or Lou Clayton. Robert Timmons submitted an assignment of permit for 13-7577 to be changed into the names of Robert Timmons and Barbara Senter (formally Barbara Timmons), along with warranty deed and divorce decree. On the original assignment of permit form, 3 water right permits were listed, of which one of them did not belong to Timmons (possible typographical error). Also, the form was submitted with insufficient fees for 3 permits (\$25 total was submitted, where the required fee is \$25 per permit). The \$25 received was applied to water right permit 13-7135, where the ownership changes were completed. A revised assignment of permit form was mailed to both Timmons and Senter on January 7, 2013 (listing the correct 3 water right permit numbers), requesting their signatures and correct fees to be submitted by January 23, 2013 (copy of letter is in 13-7576 file).

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

H. RECOMMENDATIONS**1. Recommended Amounts**

<u>BENEFICIAL USE</u>	<u>PERIOD OF USE</u>	<u>DIVERSION RATE</u>
POWER	1/01 to 12/31	0.450 CFS
<u>Totals:</u>		0.450 CFS

2. Recommended Amendments

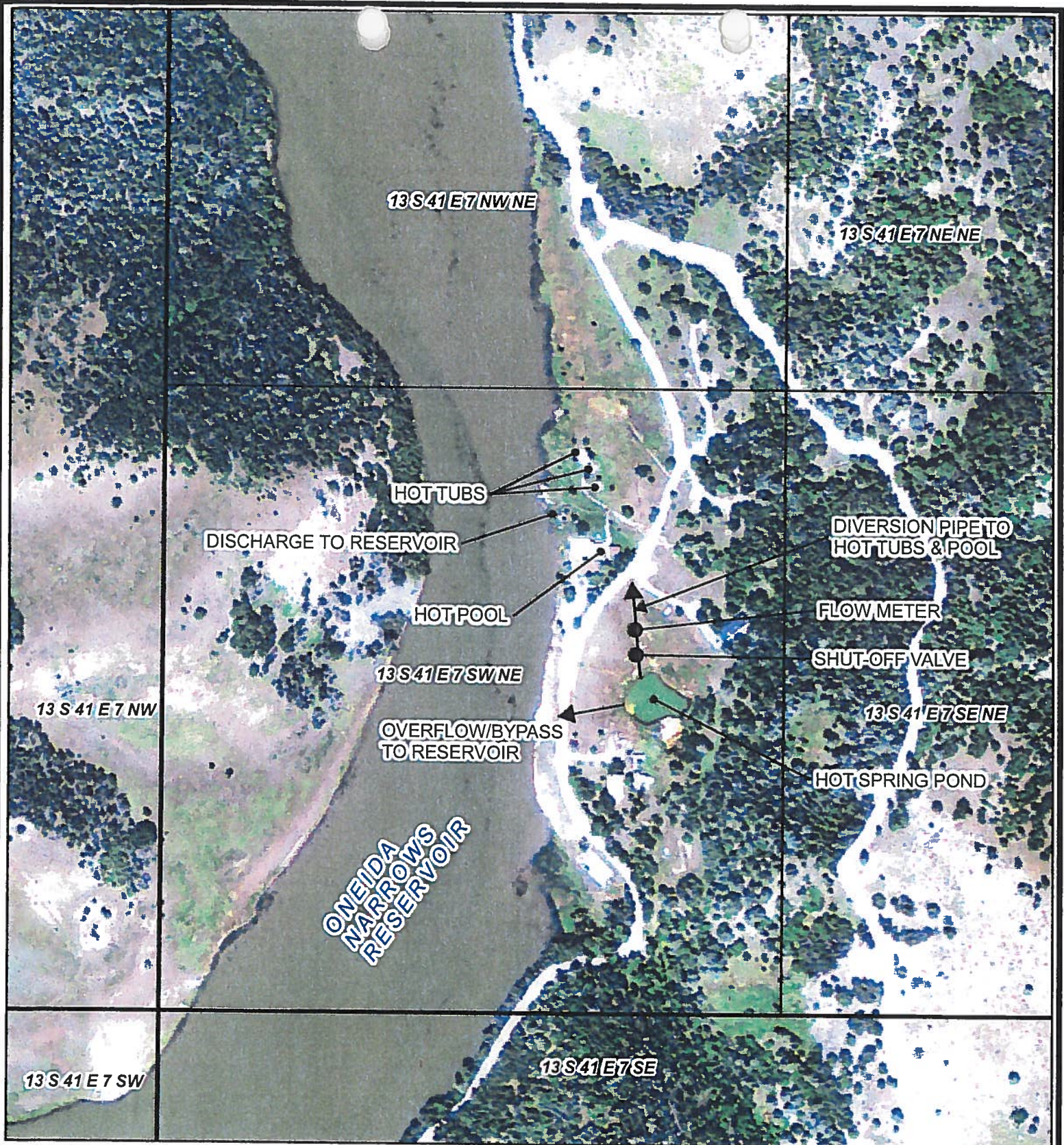
☐ Change P.D. as reflected above ☐ Add P.D. as reflected above ☒ None

☐ Change P.U. as reflected above ☐ Add P.U. as reflected above ☐ Other

I. AUTHENTICATION

Field Examiner's Name Andy Hemenway Date 1/8/2013



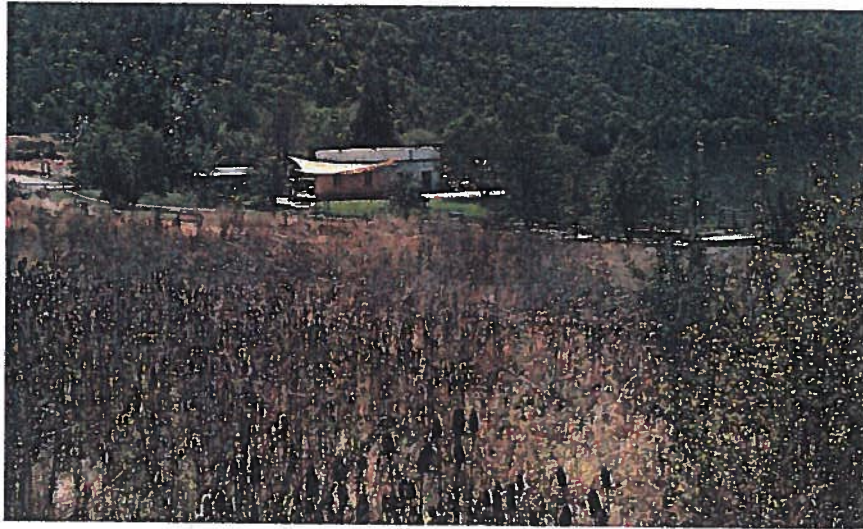


13-7576
+ 13-7577

Exhibit C.3 Aerial Photo



+ 13-7577



Overall view of resort area. Hot springs are to the left (east) of the photo. The pool is beneath the cloth canopy in front of the building. The smaller hot tub-type pools are in the grassy area near the big shade trees at the center right of the photo. The Oneida Narrows Reservoir on the Bear River is in the background on the right of the photo.



East side of hot spring pond with hot springs flowing into the pond in the background.

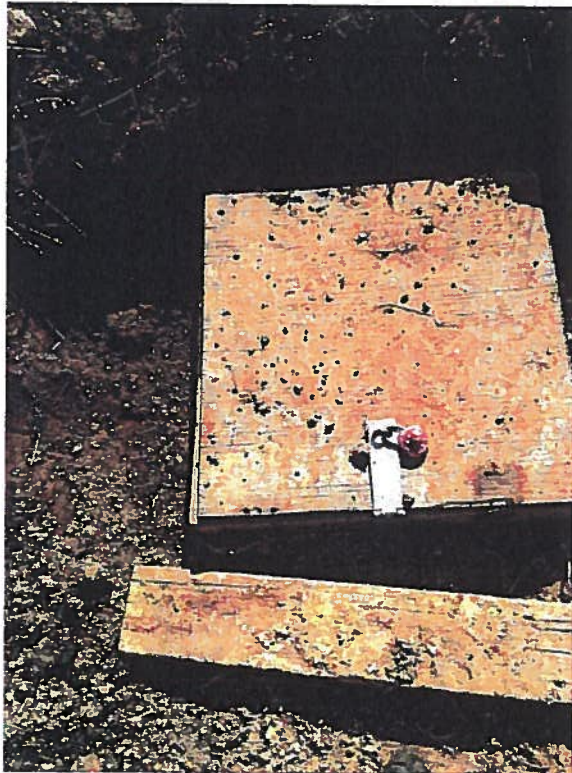


West side of hot spring pond with Oneida Narrows Reservoir in background. The valve box feeding the diversion pipe is shown at bottom right.

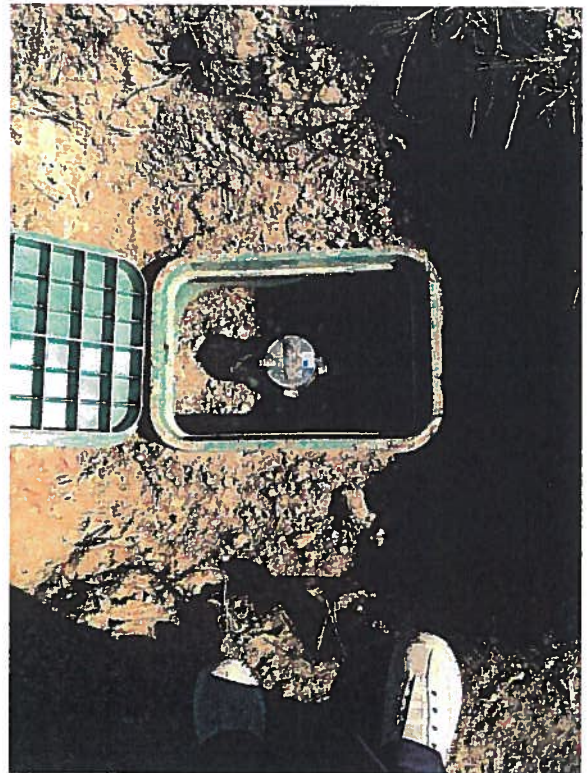
+ 13-7577



Diversion valve with box.



Diversion box with newly installed lockable closure.



Flowmeter in box downstream of valve box.

+ 13-7577

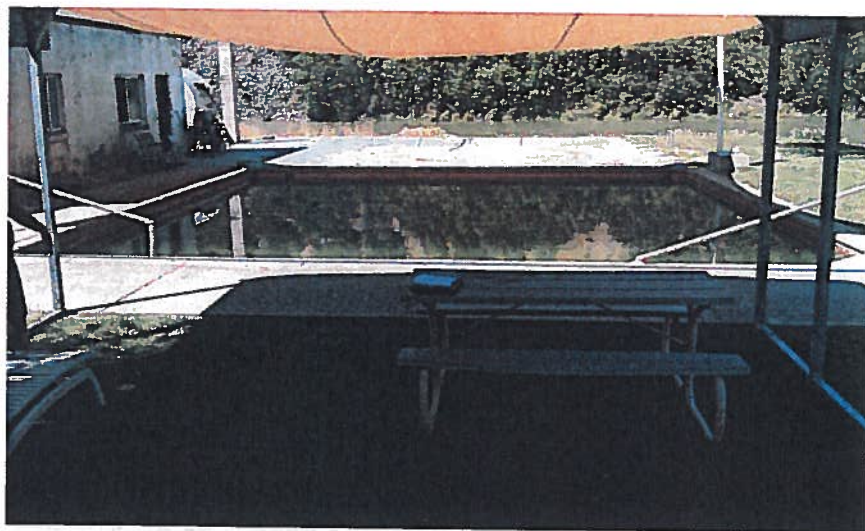


Hot spring pond overflow direct to Oneida Narrows Reservoir



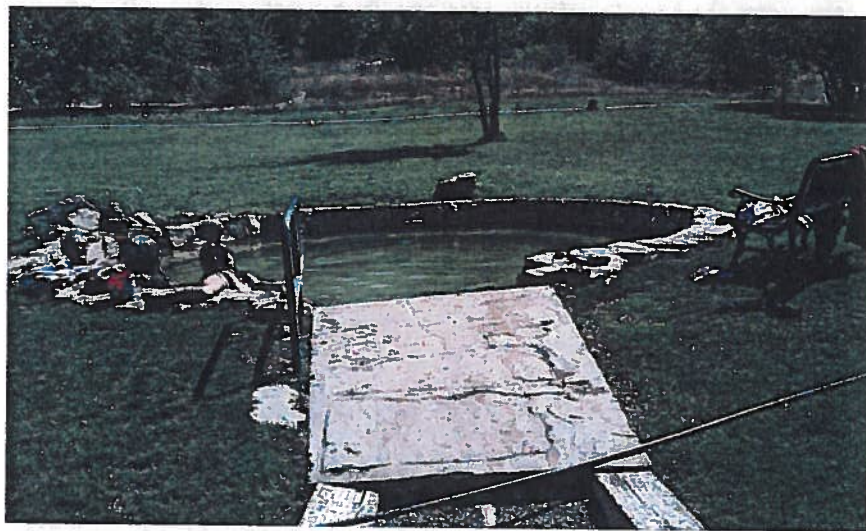
A close up view of hot springs adjacent to and east of the hot springs pond.

+ 13-7577

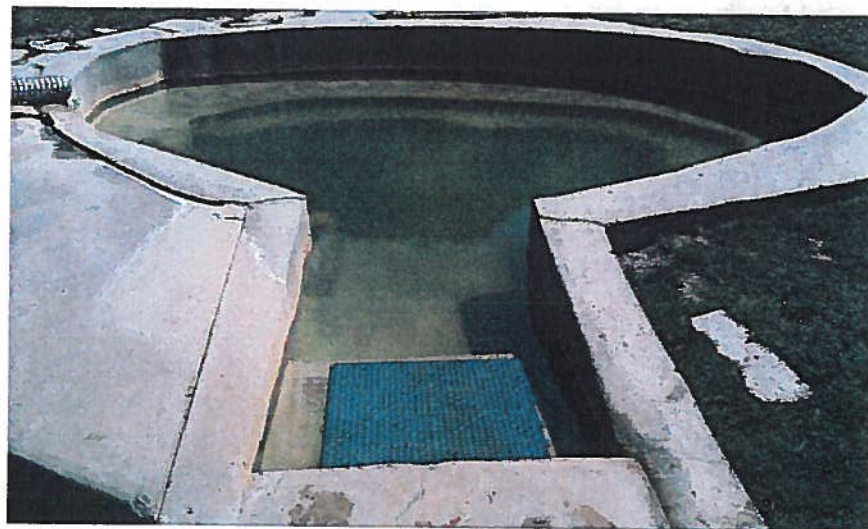


Hot pool under cloth canopy.

POY: Business building
next to pool



Hot Tub #1



Hot Tub #2

from: Memo

Appl. Processing #24 (Amended)

ATTACHMENT C

INDIVIDUAL HYDROPOWER PRODUCTION

The following is an acceptable means of evaluating water requirements for planning a small scale hydropower facility. This method is general and intended to provide approximate results for use in filing a water right permit application for development of such a facility. Sizing and selection of equipment for installation is much more complicated and should not be attempted without proper technical guidance. Any one of the following four variables can be determined by mathematical or graphical methods providing the other three are known or assumed: (See Figure 1).

- 1) Power (kilowatts)
- 2) Gross Head (feet)
- 3) Design Flow (cubic feet per second)
- 4) Efficiency

Definition and Explanation of Terms

For turbines, pelton wheels and overshot water wheels, the above variables are defined as follows:

A) Power (P)

System power production capability or system capacity is the amount of electrical power that can be generated by the hydropower system. Power demand is the amount of electrical power that is required by the user to supply electrical appliances. In order to have an operational system, power production capability must be greater than or equal to power demand. Power is commonly measured in kilowatts.

Maximum power demand can be estimated by summing the demand of all electrical appliances that may reasonably be in use at one time. The demand requirements of individual electrical appliances can usually be obtained from power suppliers or are listed on the appliances. An estimate of normal household demand can also be obtained from the following table:

Table 1: Maximum Household Power Demand

Electrical Power Use	Demand (Watts/ft ²)
Lighting and refrigeration only	2
Lighting, refrigeration, water heating, cooking and clothes drying	4-7
Total electric home	10-15

Maximum power demand in watts can be computed by multiplying demand in watts per square foot by the home size in square feet. Divide by 1000 to convert watts to kilowatts.

B) Gross Head (H)

1) Pelton Wheel or Hydraulic Turbine

Gross head for a pelton wheel or hydraulic turbine is the total vertical elevation difference in feet between the upper end of the penstock and the lower end of the penstock.

2) Overshot Water Wheel

Gross head for an overshot water wheel is the total vertical elevation difference in feet between the bottom of the discharge flume and the water surface of the tail-water.

C) Design Flow (Q)

The flow in cubic feet per second (cfs) at which the system is designed to operate.

D) Efficiency (e)

The fraction of total hydraulic energy available that can be converted to electrical energy and delivered to the consumer. For estimating purposes, use .50 for pelton wheels and turbines and .40 for overshot water wheels.

EXAMPLE PROBLEM

Problem Statement

A person with a 2000 ft² total electric home has a stream near his house which flows a minimum of 15 cfs and has a vertical drop of 400 ft. in the mile upstream from his house. The person desires to supply all of the electrical requirements of his home with a hydro-power generating system. How much water does he need?

Solution

This will be a graphical solution using Figure 1 and assuming the use of a pelton wheel or hydraulic turbine system.

1) Determine home electrical power demand.

Using Table 1

$$\begin{aligned}\text{Maximum Demand} &= 2000 \text{ ft}^2 (15 \text{ watts/ft}^2) \\ &= 30,000 \text{ watts} = 30 \text{ kw}\end{aligned}$$

2) Assume System Efficiency

Since power is assumed to be generated by a pelton wheel or hydraulic turbine, a reasonable system efficiency might be 50%. Assume $e = .5$.

3) Determine $H \times Q$ Requirement to Produce the Desired Power

Enter the graph (Figure 1) at 30 kw. Cross to the 50% efficiency line and proceed down to the lower axis and find $H \times Q = 708$.

4) Select a Head and Solve for the Flow

$H \times Q = 708$; therefore

$$Q = \frac{708}{H}$$

If $H = 400$ ft.; $Q = \frac{708}{400} = 1.8$ cfs

If $H = 200$ ft.; $Q = 3.5$ cfs

If $H = 50$ ft.; $Q = 14.2$ cfs

(It should be noted that there are an infinite number of possible solutions for $H \times Q = 708$ that provide 30 kw of power.)

Using Electricity Demand Chart for Known appliances.

13.984 Kw at 50% efficiency = $H \times Q = 325$ *

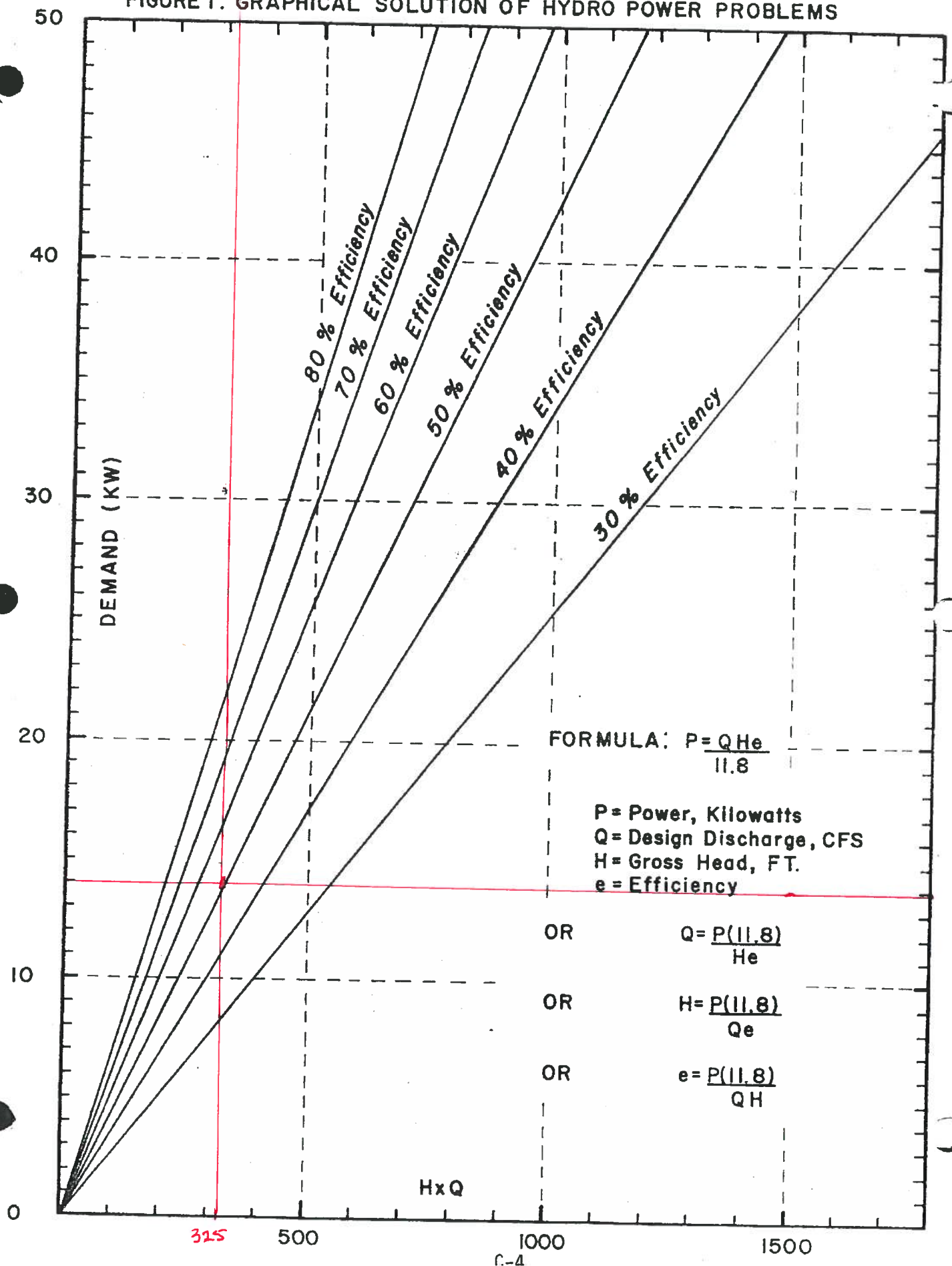
If $H = 100'$ building; $\frac{325}{100} = 3.25$ cfs

$H = 423'$ house; $\frac{325}{423} = 0.76$ cfs

* Manufacturer's email (1/9/2013) states 0.446 cfs (0.45 cfs) or 200 gpm, is required to run 1 Pelton Wheel.

C-3
* Figure 1. Graphical Solution of Hydro Power Problems

FIGURE 1: GRAPHICAL SOLUTION OF HYDRO POWER PROBLEMS



Domestic Electrical Energy Usage

The table below shows the electricity consumption of typical household electrical appliances

Appliance	Power (Watts)	Average Usage (Hours/Day)	Consumption (KWh/Day)
Heating & Cooling			
Heating (Gas/Oil) Water Pump	120	8	0.96
Immersion Heater	3000	2	6
Storage Heater 1.7kW	1700	7	11.9
Storage Heater 2.5kW	2500	7	17.5
Storage Heater 3.4kW	3400	7	23.8
Electric Blanket	180	1	0.18
Air Conditioning (2 Rooms)	3000	8	24
Lighting			
Interior (14 X 60 Watt bulbs)	840	6	5.04
Exterior & Emergency Lights	300	2	0.6
Kitchen Appliances			
Cooker Hob	3000	0.6	1.8
Cooker Oven	5000	0.4	2
Cooker Microwave	1700	0.2	0.34
Grill	1000	0.1	0.1
Barbeque	3000	0.01	0.03
Extractor Fan	200	0.3	0.06
Dish Washer	1000	3	3
Washing Machine	1000	1.5	1.5
Spin Dryer	3000	1	3
Refrigerator	300	4	1.2
Freezer	400	4	1.6
Food Mixer	500	0.04	0.02
Kettle	3000	0.25	0.75
Coffee Maker	800	0.25	0.2
Iron	2000	0.25	0.5
Toaster	1000	0.02	0.02
Garbage Disposal	500	0.04	0.02
Other Small Appliances			
Carving Knife	120	0.01	0.0012
Can Opener	120	0.01	0.0012
Bread Maker	700	0.01	0.007
Ice Cream Maker	500	0.01	0.005
Electric Frying Pan	1500	0.01	0.015
Deep Fat Frier	3000	0.01	0.03
Barbeque	3000	0.01	0.03
Large Portable Appliances			
Vacuum Cleaner	1200	0.2	0.24
Sewing Machine	150	0.01	0.0015
Bathroom			
Shower Pump	500	0.4	0.2
Electric Shower With Heater	9000	0.2	1.8
Bathroom Heater	2000	0	0
Personal Care			
Hair Dryer	1500	0.05	0.075
Hot Rollers	350	0.1	0.035
Shaver	13	0.05	0.00065
Toothbrush	13	0.05	0.025
Clock	3	24	0.072
Computer Equipment			
Desktop	300	3	0.9
Laptop	100	2	0.2
Printer	200	0.1	0.02
Scanner	100	0.04	0.004
Fax	60	0.1	0.006
Broadband Equipment	10	24	0.24
Entertainment Equipment			
Television (2 Sets)	600	5	3.0
DVD	200	1	0.2
Audio Equipment	100	1	0.1
Video Games	50	1	0.05
Standby Modes			

X 2

TV	3	24	0.072
DVD	3	24	0.072
Radio	3	24	0.072
Set top Box	3	24	0.072
Fax Machine	3	24	0.072
Cordless phones (4)	12	24	0.288
Answering Machine	3	24	0.072
Computer	6	24	0.144
Printer	3	24	0.072
Kitchen Appliances (3)	9	25	0.225
Radio Alarm Clock	5	24	0.12
Chargers			
Cordless tools	100	0.05	0.005
Portable Vacuum Cleaner	3	24	0.072
Emergency Lighting	3	24	0.072
Laptop Computer	3	24	0.072
Mobile Phones (2)	6	24	0.144
Power tools			
Drills	750	0.02	0.015
Screwdriver	250	0.02	0.005
Circular Saw	1000	0.001	0.001
Jig Saw	400	0.001	0.0004
Orbital Sander	400	0.001	0.0004
Belt Sander	800	0.001	0.0008
Angle Grinder	800	0.001	0.0008
Planer	800	0.001	0.0008
Router	1000	0.001	0.001
Power Washer	1500	0.02	0.03
Gardening Equipment			
Lawnmower	1000	0.1	0.1
Blower (Leaves/Snow)	500	0.001	0.0005
Strimmer	500	0.01	0.005
Water Pump (Filter)	50	24	1.2
Water Pump (Fountain)	50	24	1.2
Miscellaneous			
Water Pump (Well)	200	3	0.6
Fan	100	0.05	0.005
Portable Heater	2000	0.05	0.1
Garage Door Opener	500	0.05	0.025
Motors (Jacuzzi, toys)	200	0.05	0.01
Security System			
Sensors	10	24	0.24
Swimming Pool			
Pumps (2)	200	12	2.4
Heating	4500	6	27
Total			146.9809

4666 power
(watts)

13.984 KWh/day

Hemenway, Sandy

From: Energy Systems & Design [hydropow@nbnet.nb.ca]
Sent: Wednesday, January 09, 2013 6:50 AM
To: Hemenway, Sandy
Subject: RE: maximum capacity

Sandy,

At this site at least 500 watts could be generated, maybe more. This would use about 200 gpm for one machine so more power could be made using two machines. I need to know the water temperature also, to see if we need to use anything different for this machine. By the way, we are the manufacturers of these machines.

Regards,
Paul Cunningham, CEO
Energy Systems and Design
Mailing address:
PO Box 4557
Sussex, NB Canada
E4E 5L7

Shipping address:
Energy Systems and Design Ltd.
745 Waterford Rd
Waterford NB Canada E4E 5B4
Phone +1 506-433-3151
Fax +1 506-433-6151
Email hydropow@nbnet.nb.ca
Web www.microhydropower.com

From: Hemenway, Sandy [<mailto:Sandy.Hemenway@idwr.idaho.gov>]
Sent: Tuesday, January 08, 2013 3:23 PM
To: Energy Systems & Design
Cc: Hemenway, Sandy
Subject: RE: maximum capacity

In their notes, they say 30 ft head, and (16) 6 volt deep cycle batteries. There are no notes on how far they are away from the turbine. Checking Arc Map satellite imagery, the business building is 100 ft from where the pelton wheel is located, and the house is 423 ft from the pelton wheel.

From: Energy Systems & Design [<mailto:hydropow@nbnet.nb.ca>]
Sent: Tuesday, January 08, 2013 10:41 AM
To: Hemenway, Sandy
Subject: RE: maximum capacity

Sandy,

I need to know the head (or pressure) of the water at the site in order to suggest the power output. Also the battery voltage and how far they are from the turbine would be helpful.

Regards,
Paul Cunningham, CEO
Energy Systems and Design
Mailing address:
PO Box 4557
Sussex, NB Canada
E4E 5L7

Shipping address:
Energy Systems and Design Ltd.
745 Waterford Rd
Waterford NB Canada E4E 5B4
Phone +1 506-433-3151
Fax +1 506-433-6151
Email hydropow@nbnet.nb.ca
Web www.microhydropower.com

From: Hemenway, Sandy [<mailto:Sandy.Hemenway@idwr.idaho.gov>]
Sent: Tuesday, January 08, 2013 12:18 PM
To: hydropow@nbnet.nb.ca
Cc: Hemenway, Sandy
Subject: maximum capacity

Hi,

I am presently reviewing a system for water right licensing, and was wondering if I could obtain some additional information from you.

With the Stream Engine from Brunswick Canada, made by Energy Design 2, what is the maximum capacity that can be produced by this pelton wheel? The system I am reviewing has a 6 inch plastic pipe that discharges to the pelton wheel (they were not sure as to the size the pipe the 6 inch line reduces down to prior to discharging to the pelton wheel, or if it even reduces down). The measured flow from the pipe at the hot springs is 360 gpm (0.80 cfs), then continues through the 6 inch pipe about 425 ft to where the pelton wheel is located. Do you know how many gallons per minute are required to effectively run this pelton wheel. They did indicate that they have (16) 6-volt deep cycle batteries for power storage.

Any help you can give me will be greatly appreciated. If you have some kind of fact sheet that I could include with my report, that would be great.

Thanks so much,

Sandy Hemenway

Sr. Water Resource Agent
IDWR/State Office
PO Box 83720 or 322 E. Front St.
Boise, ID 83720-0098
OFFICE: (208) 287-4920
CELL: (208) 761-0280

FAX: (208) 287-6700
Email: sandy.hemenway@idwr.idaho.gov

No virus found in this message.

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Version: 2013.0.2805 / Virus Database: 2637/6016 - Release Date: 01/07/13

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Version: 2013.0.2805 / Virus Database: 2637/6016 - Release Date: 01/07/13

Stream Engine® and EASY TUNE ® Stream Engine

EASY TUNE ® Stream Engine - Microhydro machine

"Home of the Stream Engine™"



Buy directly from the inventor and manufacturer.

The amazing Stream Engine is also available as the **EASY TUNE ®** Another ES&D first...MORE POWER TO YOU



***The Stream Engine**, employs a brushless, permanent magnet alternator which is adjustable, enabling the user to match turbine output to the electrical load. It has higher efficiency than previous alternators, and is capable of outputs up to 1+ kilowatt (kW). It is equipped with a rugged bronze turgo wheel, universal nozzles (adaptable to sizing from 3 mm (1/8 inch) to 25 mm (1 inch), or brass nozzle inserts, and a digital multimeter which is used to measure output current. The entire system is made of non-corrosive alloys for long life and durability.*

This machine is made here, with the best care and quality. ESD makes its own generators which are the most efficient for the hydro machine.

The Easy Tune Stream Engine additional features

- **More power from a water source, manual MPPT, efficient**
- **More from a micro hydro machine 2KW +**
- **More output options 12, 24, 48 volts and higher**
- **More easily tuned – while machine is running match your site**
- **More user friendly – easy to install and service**
- **Widest operating range 10 feet of head and up, 1-4 nozzles**

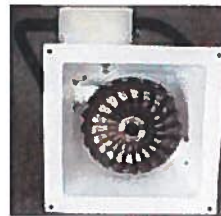
This machine can produce power from heads as low as 3 metres (10 feet) to over 100 metres (300 feet). The amount of power a site can generate depends on the head and flow available at the site.

A general formula for Stream Engine WATTS OF OUTPUT***head(in feet) times flow (in gallons per minute) divided by 10******in metric head (in meters) times flow (in liters per second) times 5***

This would be continuous output, DC. For kwh per day multiply by 0.024. For example a machine producing 1000 watts would produce 24 kwh per day. For a monthly total multiply by thirty. A machine making 1000 watts would produce 720kwh per month.

Features:

- A rugged bronze turgo wheel
- Adjustable output Permanent Magnet Alternator
- Non-Corrosive Precision Made Parts.
- Operates with heads of 3 metres minimum
- Explanatory manual and *multimeter* included.
- Straightforward Installation
- 1 Year Warranty
- [Stream Engine Turbine Brochure](#)
- [Easy Tune Stream Engine Manual](#)



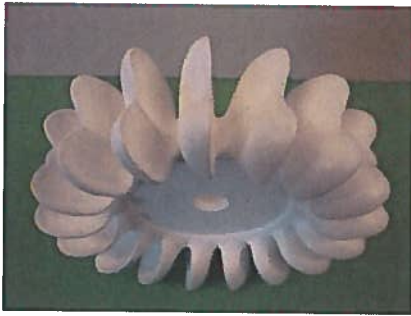
Typically, these systems operate at 12, 24, or 48 volts, with re-connectable wiring which allows the user to install a standard turbine at most sites. Custom windings are also available which can produce high voltage (120, 240) at any site.

Our Prices are on the price list page

Energy Systems & Design 2011

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Pelton Wheel



Energy Systems & Design's Pelton – This popular, plastic pelton wheel is useful in higher head, lower flow situations where outputs will not be excessive. With a 10 cm pitch diameter (4 inch), it is ideal for small, do-it-yourself applications. The peltons are supplied with a 13mm (1/2") bore and can

use nozzles up to 1/2" diameter.

The wheel can be used on a shaft or arbor that the customer supplies, or on an ESD stainless steel hub (hub sold separately). These hubs are designed to fit Ford or Delco alternators with a 17mm diameter shaft with 20TPI threads, or an ESD generator. We can bore a custom size hole if needed.

Energy Systems & Design 2011

Warning: you are using an old version of Internet Explorer. Please [upgrade](#) to IE 8 or later for maximum site compatibility!

The Stream Engine®

Owner's Manual

Please Read Carefully

Made in North America

By

Energy Systems & Design

PO Box 4557
Sussex NB
Canada E4E 5L7

Phone +1 (506) 433-3151

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Email: support@microhydropower.com

Website: www.microhydropower.com

The **Stream Engine** is a Trademark of Energy Systems & Design Ltd.

V1.6 rev 2-2010

Congratulations on your purchase of a new *Stream Engine*! With a proper installation and a little routine maintenance, your Stream Engine will provide you with years of trouble-free operation. This manual will help you to install your Stream Engine as well as assist you in trouble-shooting and problem solving. Of course, you may contact Energy Systems & Design Ltd. if you run into trouble.

May your RE adventures prove successful!

PLEASE READ CAREFULLY

It is very important to keep the alternator rotor from contacting the stator (the stationary part under the rotor). If this occurs, serious damage may result.

Whenever you are operating the machine with a small air gap (distance between alternator rotor and stator) you should check the gap whenever an adjustment is made!

Do this by inserting a shim 0.020" (0.5mm) thick in the gap when the rotor is stationary (most business cards are 0.010" (0.25mm) thick, therefore, using two business cards of this thickness could be used to check the air gap). Check all the way around the rotor. This is also a way to check for bearing wear on a monthly basis. If you **cannot** easily insert the shim into the gap, either all or in part, it is necessary to adjust the rotor upward (see *Output Adjustment* in this manual). **DO NOT** USE steel feeler gauges as they will be attracted to the magnets.

When making air gap adjustments, make sure the larger bolt is tightened (clockwise) against the shaft and the smaller bolt is also tightened (clockwise); so as to lock both parts in place.

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INTRODUCTION

This manual describes **The Stream Engine**, which is manufactured by Energy Systems and Design Ltd. The installer must have some knowledge of plumbing and electrical systems, as should the end user of the system. These machines are small, but can generate very high voltages. Even 12-volt machines can produce high voltages under certain conditions. Practice all due safety. Electricity cannot be seen and can be lethal.

It is important to consult with local officials before conducting any watercourse alteration. ES&D advises following all local laws and ordinances regarding watercourses.

Electricity is produced from the potential energy in water moving from a high point to a lower one. This distance is called "head" and is measured in units of distance (feet, meters) or in units of pressure (pounds per square inch, kilo-Pascals). "Flow" is measured in units of volume (gallons per minute - gpm, or liters per second - l/s), and is the second portion of the power equation. The power available is related to the head and the flow.

The Stream Engine is designed to operate over a wide range of heads and flows. This is achieved with the use of a Turgo runner, or wheel. Nozzle diameters of 1/8 to 1 inch (3-25mm) are available, and up to four nozzles can be used on one machine, to utilize heads as low as four feet and as high as hundreds.

The Stream Engine uses a permanent magnet type alternator. This design eliminates the need for brushes and the maintenance that accompany them while increasing efficiency. The Stream Engine's output can be optimized by simply adjusting the rotor clearance.

SITE EVALUATION

Certain information must be determined concerning your site, in order to use its potential for maximum output. Head and flow must first be determined. Other factors are: pipeline length, transmission distance, and the system voltage. These factors determine how much power can be expected.

Power is generated at a constant rate by the Stream Engine and stored in batteries as direct current (DC). Power is supplied, as needed, by the batteries, which store energy during periods of low consumption for use in periods where consumption exceeds the generation rate. Appliances can be used that operate directly from batteries, or 120 volt alternating current (AC) power can be supplied through an inverter, converting DC to AC power.

Sites may vary, so carefully consider flow and head when choosing yours. Remember, maximum head can be achieved by placing the Stream Engine at as low an elevation as possible, but going too low may cause the machine to become submerged (or washed away!).

HEAD MEASUREMENT

Head may be measured using various techniques. A garden hose or length of pipe can be submerged with one end upstream and the other end downstream. Anchor the upstream end with rocks or have an assistant hold it; water should flow out the low end, especially if the pipeline is pre-filled. Once water is flowing, raise the downstream end until it stops. Do this slowly since the water tends to oscillate. When the flow has stabilized, measure the distance down to the level of water in the stream with a tape measure. This will give a very accurate measurement of that stream section. Mark the spot and then repeat the procedure until the entire distance is covered.

The weir method is more versatile and may prove useful for higher flows. This technique uses a rectangular opening cut in a board or piece of sheet metal set into the brook like a dam. The water is channeled into the weir and the depth is measured from the top of a stake that is level with the edge of the weir and several feet upstream. Looking at the chart that follows will enable you to convert the width and depth of flowing water into gallons per minute.

Measuring the flow at different times of the year helps you estimate maximum and minimum usable flows. If the water source is seasonally limited, you may have to depend on some other source of power during dry times (solar, wind). Keep in mind that a reasonable amount of water must be left in the stream (Don't take it all, that water supports life forms).

When head and flow are determined, the expected power output can be determined from the following chart. Keep in mind that chart values represent *generated* output and that actual power delivered to the batteries will be reduced by transmission lines, power converters, and other equipment required by the system. All systems should be carefully planned to maximize power output.

Stream Engine Output in Watts (Continuous)

Net Head		Flow Rate						
		Liters/sec (Gallons/min)						
Meters	Feet	0.67 (10)	1.33 (20)	2.50 (40)	5.00 (75)	6.67 (100)	7.50 (112)	9.50 (150)
3	10	-	20	40	75	100	130	150
6	20	15	40	80	150	200	250	350
15	49	45	100	200	375	500	650	800
30	98	80	200	400	750	1000	*	*
60	197	150	400	800	1500	*	*	*
90	295	200	550	1200	*	*	*	*
120	394	300	700	1500	*	*	*	*
150	492	400	850	1900	*	*	*	*

* In these higher output situations, it may be worthwhile to utilize more than one Stream Engine.

INTAKE, PIPELINE, AND TAILRACE

Most hydro systems require a pipeline. Even systems operating directly from a dam require at least a short plumbing run. It is important to use the correct type and size of pipe to minimize restrictions in the flow to the nozzle(s). When possible, pipelines should be buried; this stabilizes the line and prevents animals from chewing it.

At the inlet of the pipe, a filter should be installed. A screened box can be used with the pipe entering one side, or add a section of pipe drilled full of holes wrapped with screen or small holes and used without screen. Make sure that the filter openings are smaller than the smallest nozzle used. Note that particles over about $\frac{1}{4}$ " or 6mm in size may lodge in the runner.

The intake must be above the streambed so as not to suck in silt and should be deep enough so as not to suck in air. The intake structure should be placed to one side of the main flow of the stream so that the force of the flowing water and its debris bypasses it. Routinely clean the intake of any leaves or other debris.

If the whole pipeline doesn't run continuously downhill, at least the first section should, so the water can begin flowing. A bypass valve may be necessary. This should be installed at a low point in the pipe.

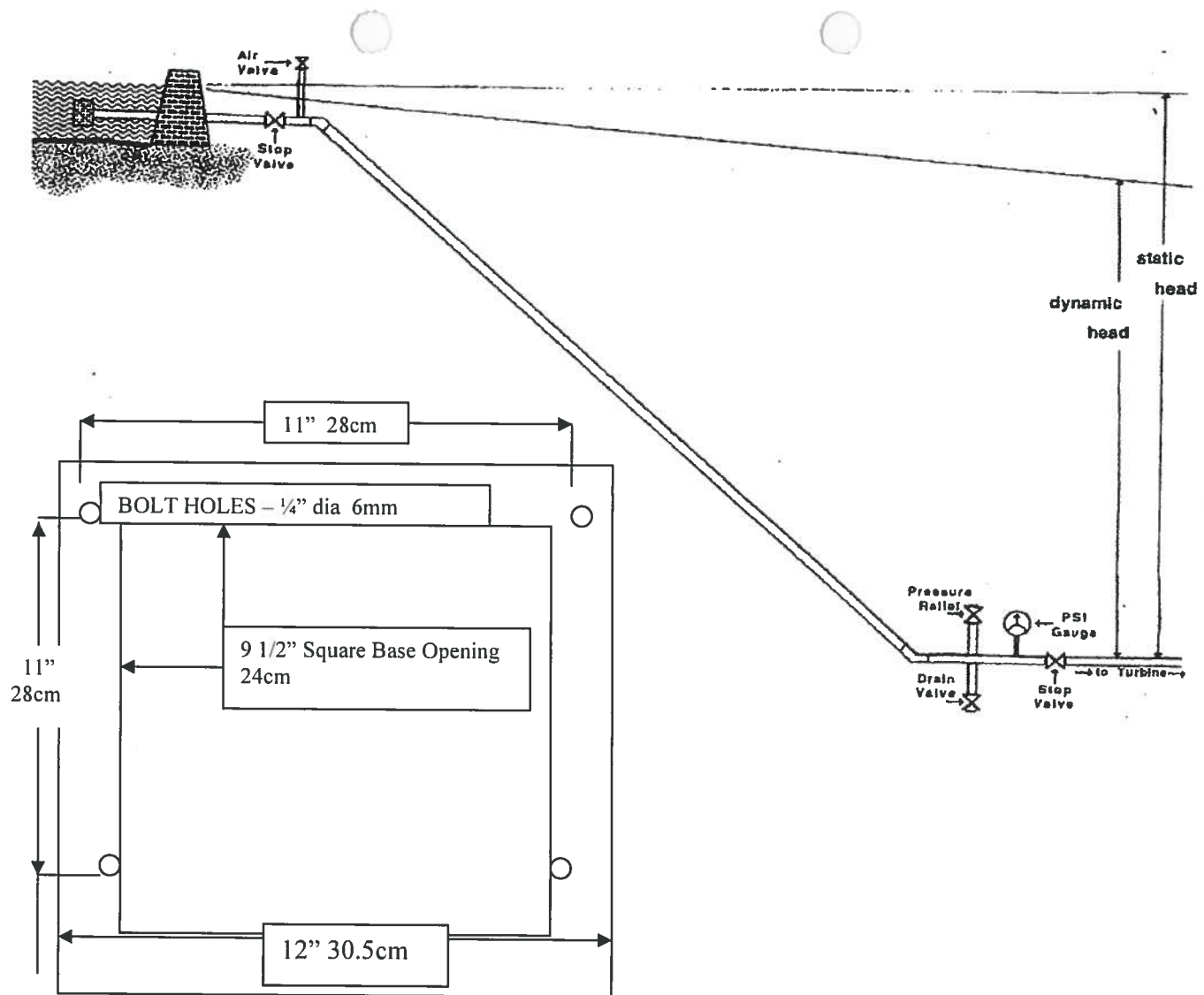
For pipelines running over dams, or in conditions that create a siphon, the downstream side may be filled by hand. Once filled, the stop valve at the turbine can be opened to start the flow. If full pressure is not developed, or air builds up in the line, a hand-powered vacuum pump can be used to remove air trapped at the high point.

At the turbine end of the pipeline a bypass valve may be necessary to allow water to run through the pipe without affecting the turbine, purging the line of air or increasing flow to prevent freezing.

A stop valve should be installed upstream of the nozzle. A pressure gauge should be installed upstream of the stop valve so both the static head (no water flowing) and the dynamic head (water flowing) can be read.

The stop valve on a pipeline should always be closed slowly to prevent water hammer (the column of water in the pipe coming to an abrupt stop). This can easily destroy your pipeline and for this reason, you may wish to install a pressure relief valve just upstream of the stop valve. This can also occur if debris clogs the nozzle. In a single nozzle machine a nozzle that becomes clogged suddenly may create a water hammer.

Nozzles can be installed or changed by removing the nozzle. The nozzle is removed by unscrewing its four nuts using a $\frac{7}{16}$ " (11 mm) wrench. The use of flexible pipe makes it easier to remove the plumbing from the nozzles.



The turbine housing can be mounted on two boards to suspend it above the stream. It is recommended to have the Stream Engine in a small enclosure or under some cover to keep it dry and provide a place for auxiliary equipment. Mounting the machine in concrete is also possible (you may wish to try a temporary wood mounting first). The opening under the housing to catch the water should be at least the size of the turbine housing opening, and preferably a little larger. Make certain the tailrace (exit channel) provides enough flow for the exiting water. The diameter of the bolt holes is $\frac{1}{4}$ " (6mm).

In cold climates, it may be necessary to build a "trap" into the exit. This prevents outside air from entering the housing and causing freeze-ups.

BATTERIES, INVERTERS & CONTROLLERS

System Voltage

A small system with a short transmission distance can be designed to operate at 12 volts. Larger systems can also be 12 volts, but if higher power is desired or the transmission distance is long, then a system of 24 volts or higher may be preferable. This is especially true if all loads are inverter-powered. In a 12-volt system operating at a low power level, it may be advantageous to operate all loads directly from batteries. Many 12-volt appliances and small inverters are available. In 24-volt systems, it may also be preferable to operate the loads directly (although not as many appliances are available).

In higher power systems, it is usually better to use an inverter to convert battery voltage to regular 120 volt AC power at 60Hz (cycles per second), or 240 volt 50Hz in some countries. This has been made feasible with the advent of reliable high power inverters. Thousands of home power systems are in operation with only AC loads.

Sizing Battery Bank

A typical hydro system should have about one or two days of battery storage capacity. This will generally keep lead-acid cells operating in the middle of their charge range where they are the most efficient and long-lived.

Batteries should be located outside of any living space, or adequate ventilation should be provided, as a rising charge level tends to produce both hydrogen gas and corrosive fumes. Also, distilled water should be added as needed to maintain the electrolyte level.

Charge Control

Unlike solar systems, a hydro system must always be connected to a load even when the batteries are fully charged. If the output power does not have a load, system voltage can rise to very high levels. This situation provides an opportunity to do something with the excess power like water or space heating.

As the batteries become fully charged, their voltage rises. At some point, the charging process should stop and the excess power be diverted to the dump load. Most charge controllers permit different charge levels such as bulk, absorption, and float. Literature supplied with the controller should be consulted to determine the set points of the charge controller.

Watt-Hour meters are available that monitor the battery state of charge.

An ammeter that monitors turbine output should always be installed in a high traffic or living space so difficulties with the machine can be easily detected. If a drop in output is noticed, the machine should be inspected. This could be caused by air in the pipeline, or a blocked or partially blocked nozzle. More importantly, a drop in output could be the beginning of bearing failure. Bearing failure will cause serious damage to the machine. Early detection of problems with the bearings is vital.

WIRING AND LOAD CENTER

Every system requires wiring to connect the various components. Load centers are available as a complete package that easily facilitates the connection of loads and power source(s). All circuits in the system should use wire of adequate size and have fuses or breakers of sufficient capacity to carry the expected load current. The Stream Engine must be fused since it can suffer from a short or similar fault just like anything else in the system.

Inside the junction box on the side of the machine are two terminals for the battery wiring that are mounted to the plastic terminal board. The positive terminal is painted red. Your transmission wire ends are inserted into these two connectors (after being stripped of insulation) and then tightened. Make sure that the battery wiring is correctly connected or the rectifier will be destroyed. Do not operate the machine without being connected to the batteries as very high voltages may be generated. A grounding terminal on the side of the box is painted green.

The supplied multi-meter can be temporarily connected to the test jacks on the side of the junction box (see *current measurement technique*, pg. 18) which will measure current output and is used when adjusting the output.

DESIGN EXAMPLE

This example shows how to proceed with a complete installation. The parameters of the example site are:

- 120 feet of head over a distance of 1000 feet
- a flow of 30 gpm (most of the time)
- 100 feet of distance from the house to the hydro machine
- 24 volt system

The first thing we do is determine the pipeline size. Although maximum power is produced from a given size pipe when the flow loss is 1/3 of the static head, more power can be obtained from the same flow with a larger pipe, which has lower losses. Therefore, pipe size must be optimized based on economics.

The pipe flow charts show us that two-inch diameter polyethylene pipe has a head loss of 1.77 feet of head per 100 feet of pipe at a flow rate of 30 gpm. This is 17.7 feet of loss for 1000 feet of pipe.

Using two-inch PVC gives us a loss of 1.17 feet of head per 100 feet of pipe or 11.7 feet for 1000 feet.

Polyethylene comes in continuous coils because it is flexible (and more freeze resistant). PVC comes in shorter lengths and has to be glued together or purchased with gaskets (for larger sizes). Let's say we select polyethylene.

The maximum output occurs with a flow of about 45 gpm since that gives us a head loss of 3.75 feet per 100 feet of pipe, or 37.5 feet of loss for our 1000 feet of pipe. This is $37.5' \text{ loss} / 120' \text{ head} = 31\%$ loss.

A flow of 30 gpm gives a net head of 102.3 feet ($120' - 17.7'$). The losses caused by the various pipe fittings and intake screen will further decrease the dynamic head, so 100 feet is a good working figure for the net head. Looking at the nozzle flow chart, we see that a 3/8" nozzle will produce a flow of 27.6 gpm at a head of 100'. This is very close to the design point and the net head will be a bit higher since the flow is less. Looking at the output chart we see that the machine could generate about 300 watts. That is, at a 30 meter head or about 100 feet and halfway between 20 and 40 gpm.

A simple rule of thumb to use is to multiply the head in feet (meters) by the flow in gpm (liters per second) and divide by ten (multiply by five for metric or SI units) which will roughly give the output in watts.

Since we require 24 volts and the transmission distance is fairly short, we can generate and transmit 24 volts using the Stream Engine. This Stream Engine could also be used for higher voltages like 48 and 120 or 240. With higher voltages, the power could be transmitted longer distances.

We need to go 100' with 300 watts at our site. This will be about 10 amps at 30 volts at the generator. Note that there will be some voltage drop in the line and 24-volt batteries require somewhat higher voltages than nominal to become charged. So the 10 amps must pass through 200' of wire for the round trip. Resistance losses should be kept as low as economics permit, just like the pipeline losses.

Let's say we can accept around a 10% loss. This is 30 watts out of the original 300. The formula for resistive loss is $I^2R = \text{watts}$. I = Intensity (current in amps) and R = Resistance (in ohms).

$$\begin{aligned}(10 \text{ amps})^2 \times R (\text{ohms}) &= 30 \text{ watts} \\ 100 \text{ amps} \times R (\text{ohms}) &= 30 \text{ watts} \\ R &= 30 \text{ watts}/100 \text{ amps} \\ R &= 0.3 \text{ ohms}\end{aligned}$$

This is the wire resistance that will produce a 10% loss. The wire loss chart shows loss per 1000', so:

$$1000'/200' \times 0.3 \text{ ohms} = 1.5 \text{ ohms per } 1000'.$$

The chart shows 12 ga. Wire has a resistance of 1.62 ohms per 1000', so:

$$\begin{aligned}200'/1000' \times 1.62 \text{ ohms} &= 0.32 \text{ ohms. This is close to the desired level.} \\ 10 \text{ amps} \times 10 \text{ amps} \times 0.32 \text{ ohms} &= 32 \text{ watts of loss.}\end{aligned}$$

Increasing the wire size further would reduce the losses. Voltage drop in the wire is equal to:

$$IR = 10 \text{ amps} \times 0.32 \text{ ohms} = 3.2 \text{ volts}$$

So if the battery voltage is 26.8 the generator will be operating at 30.0 volts. Keep in mind that it is always the batteries that determine the system voltage. That is, all voltages in the system rise and fall according to the battery's state of charge.

At the site, we would be generating 10 amps continuously. If we use lead acid batteries and wish to have two days of storage capacity, then:

$$10 \text{ amps} \times 24 \text{ hrs} \times 2 \text{ days} = 480 \text{ amp. hours (Ah) Capacity}$$

We would probably use an inverter and load controller with the system. The diagram for such a system would look like this:

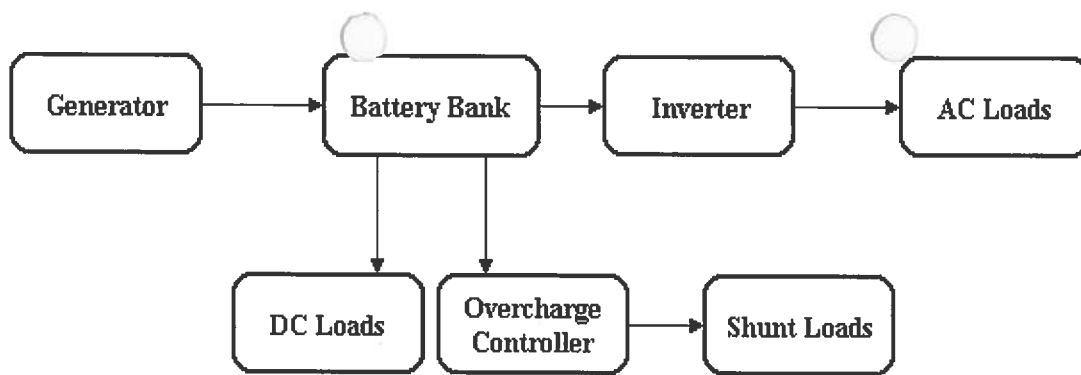


Diagram of a typical battery-based system:

OUTPUT ADJUSTMENT

For the machine to produce the highest output, the rotor height should be adjusted. This involves raising or lowering the rotor to change the magnetic flux level. This is necessary to match the output of the turbine with that of the generator which optimizes output.

After the machine is installed, perform an initial run to establish a power output level. This can be determined using the method described on page 18. After everything is hooked up, start the machine by opening the stop valve. Run it long enough for the output level to stabilize and note the current (or voltage in the case of a long distance transmission AC machine). Then shut the stop valve. Since the machine comes with the rotor set very close to the stator (the stationary part of the machine), you will need to adjust the rotor upwards to see if this gives a power increase. To increase this distance and reduce the magnetic flux level, first insert the 1/4" pin supplied in one of the holes in the edge of the rotor. Then the smaller 7/16"(11 mm) head bolt is loosened while using the pin to keep the rotor from turning. Now you can turn the larger 3/4" bolt, which will force the rotor up. Each full turn of the bolt will move the rotor vertically 0.050"(1.25 mm). If raising the rotor causes the current (or the voltage) to increase, then continue to do so until there is no longer an increase. If a point is reached where a decrease occurs, then the rotor should be lowered. This is done by loosening the larger bolt and then tightening the smaller one. Turning the smaller bolt causes the rotor to move vertically the same distance per turn as the larger bolt does. When you have found the best position (no increase in current or voltage), make sure the larger bolt is turned until it has contacted the shaft but not enough to change your adjustment. Now the smaller bolt should be tightened securely to lock everything in place. No further adjustments should be required unless nozzle sizes are changed.

When adjusting the rotor downward, it may reach the point where it will contact the stator. If this occurs, always adjust it upwards by at least a 1/2 turn of the larger bolt. Operating the machine with the rotor closer than this may damage the machine. Be sure the air gap is at least 0.020" (0.5 mm) as described on page two.

**** Always turn the rotor by hand before starting the machine to check for rubbing**.**
Remove the pin in the rotor edge before starting the machine.

High Voltage models Only

When operating a Stream Engine using transformers, it will require a different technique in order to optimize the output. This can be done at the turbine by adjusting for maximum voltage rather than maximum current. AC voltage can be measured using any two of the test jacks with the meter set on one of the AC scales. Make rotor air gap adjustments according to the above instructions.

DETERMINING NOZZLE SIZE

Optimum nozzle size can be determined by following the Design Example (page nine) using the Nozzle Flow Chart. It usually works best to use nozzles in the middle of the size range whenever possible. When using two or more nozzles they do not have to be the same diameter.

Two types of turbine runners are offered for the Stream Engine; a standard turgo runner and a high head low flow runner.

The standard turgo runner can use nozzles of up to one inch in diameter. This is used for higher flow sites which are associated with lower heads. The universal type of nozzle is supplied with the conventional runner. With the universal nozzle, it is possible to create any size nozzle jet that might be required by simply cutting the nozzle to the appropriate length. Cutting can be done with a hacksaw, or any other fine toothed saw. The end of the nozzle should then be finished with a piece of sandpaper. This is best done by placing the sandpaper on a flat surface and moving the nozzle against it. Markings are on the nozzle to assist in cutting to the correct size. The numbers are in millimeters and correspond to inches as follows:

mm	3	4.5	6	8	10	13	16	19	22	25
inches	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1

The low flow runner comes with brass nozzle inserts that are supplied in sizes of 1/8" to 1/2" (lettered A-G) in increments of 1/16". These inserts are screwed into a plastic flange."

Both the standard Stream Engine and the low flow version are supplied with nozzle flanges with 1 1/2" male pipe thread that is connected to the incoming plumbing. It is best to use 2 inch flexible hose which will fit over the threaded end. The hose can be secured with hose clamps as shown in the pictures on pages 19- 20. Using flexible hose simplifies the plumbing and makes nozzle removal easier.

NOZZLE FLOW CHART FLOW RATE IN U.S. GALLONS PER MINUTE

Head Feet	Pressure PSI	Nozzle Diameter, inches											Turbine RPM
		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	8.40	11.0	17.1	24.7	33.6	43.9	460
10	4.3			3.88	6.05	8.75	11.6	15.6	24.2	35.0	47.6	62.1	650
15	6.5		2.68	4.76	7.40	10.7	14.6	19.0	29.7	42.8	58.2	76.0	800
20	8.7	1.37	3.09	5.49	8.56	12.4	16.8	22.0	34.3	49.4	67.3	87.8	925
30	13.0	1.68	3.78	6.72	10.5	15.1	20.6	26.9	42.0	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	26.0	2.38	5.35	9.51	14.8	21.4	29.1	38.0	59.4	85.6	117	152	1600
80	34.6	2.75	6.18	11.0	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	37.6	49.1	76.7	111	150	196	2070
120	52.0	3.36	7.56	13.4	21.0	30.3	41.2	53.8	84.1	121	165	215	2270
150	65.0	3.76	8.95	15.0	23.5	33.8	46.0	60.1	93.9	135	184	241	2540
200	86.6	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	12.0	21.3	33.2	47.8	65.1	85.1	133	191	261	340	3591
400	173	6.14	13.8	24.5	38.3	55.2	75.2	98.2	154	221	301	393	4140

Note: This chart is for one nozzle. More than one nozzle can be used to accommodate greater flow. If head and flow conditions are at machine capacity increasing nozzle size will only produce slightly more power. The Stream Engine can generate a maximum of about 500 watts per 1000 rpm.

BEARINGS, SERVICE & ASSEMBLY

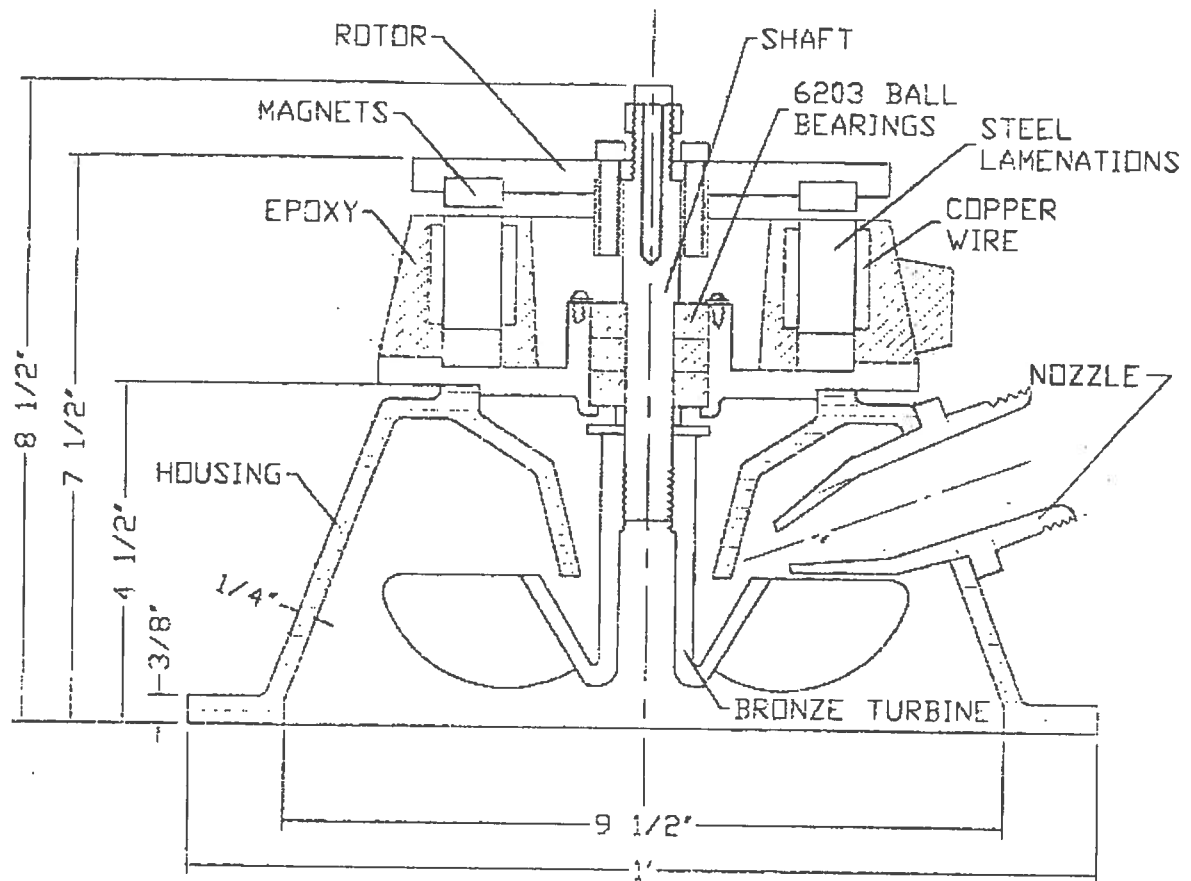
In order to replace bearings, the turbine runner must first be removed. The Stream Engine can be equipped with either of two types of turbine runner, the standard turgo or the low-flow runner. The turgo is removed from the shaft by first securing the magnet rotor on the top of the machine from rotating using the supplied ¼" diameter steel pin inserted into one of the holes in the edge of the rotor. Then the turgo runner can be unscrewed from the shaft by turning it in a counter-clockwise direction, just like a nut would be. If you cannot hold the runner securely with your hands, you may have to drive wooden wedges between the runner edge and the housing to keep it from moving and then turning the rotor. The low-flow runner can be removed by unscrewing the center bolt using a 5/16" (8mm) Allen wrench. In the case of the low-flow runner, you will need to remove the generator and you now have access to the four 7/16" (11 mm) nuts that secure it to the housing. Once the generator is removed, you will need to unscrew the stainless steel shaft adapter by turning it with the supplied longer pin. Now you can proceed to remove the shaft and magnet rotor of either type of machine by following these directions:

IMPORTANT Bearing maintenance is important. You should replace bearings **ONCE PER YEAR** or as soon as you notice any looseness from wear. If they are too loose, severe damage to both the rotor and the stator can result. Check the clearance often making sure you can insert two business cards (or something the same thickness) between the rotor magnets and the stator. Even if the bearings are not worn, changing them once per year will help keep the area free of corrosion and make future bearing changes easier. This machine uses three 6203 ball bearings with contact seals. Presently the bearings in the machine are a slip fit in the housing bore and Loctite 243 has been applied to the bearings before assembly in order to secure them. This adhesive and corrosion may make the bearing difficult to remove. Tapping with a block of wood should be sufficient but the use of a press may be required if the bearings are stuck in the housing.

To replace bearings:

1. To remove the rotor and shaft assembly, raise the rotor as described in *output adjustment* until the magnetic attraction is low enough to raise and separate the rotor/shaft assembly from the stator.
2. Unscrew two 7/16" (11 mm) bolts that retain the bearings.
3. With the generator inverted, using your thumbs, push out the bearings from the housing or tap the bearings out. This may require a press in some situations.
4. Clean bearing sleeve and insert new 6203 bearings and apply Loctite 243 or equivalent. .
5. Reassemble.

Note: Replace the washer and the spacer above the turgo or the shaft adapter with the spacer above the washer as shown in the following drawing.



Note : The Stream Engine Low Flow runner uses a hub adaptor to attach to the shaft.

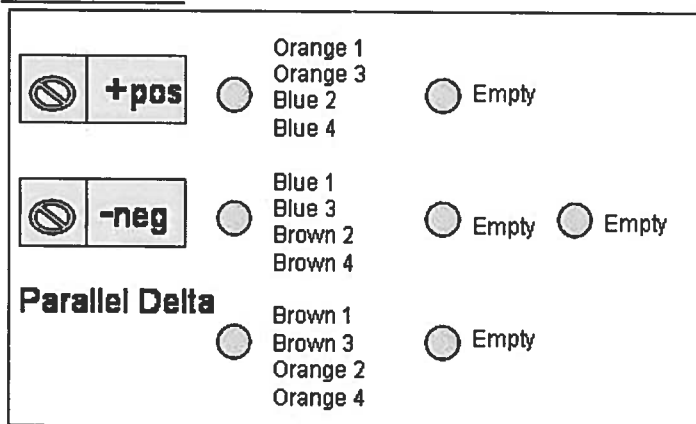
Copper Wire Resistance Chart

Wire Gauge	Diameter Inches	Ohms per 1000'	Ohms per Mile
0000	0.460	0.05	0.26
000	0.410	0.06	0.33
00	0.364	0.08	0.42
0	0.324	0.10	0.52
2	0.258	0.16	0.84
4	0.204	0.25	1.34
6	0.162	0.40	2.13
8	0.128	0.64	3.38
10	0.102	1.02	5.38
12	0.081	1.62	8.56
14	0.064	2.58	13.6
16	0.051	4.10	21.6
18	0.040	6.52	34.4

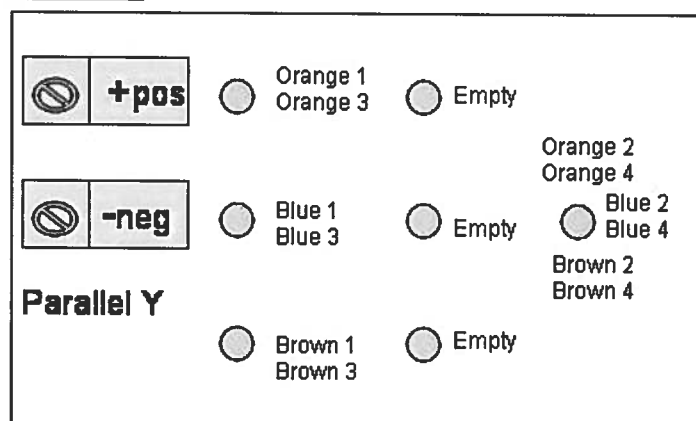
PIPE FRICTION LOSS - PVC Class 160 PSI Plastic Pipe
 Pressure Loss from Friction in Feet of Head per 100 Feet of Pipe

Flow US GPM	Pipe Diameter, Inches										
	1	1.25	1.5	2	2.5	3	4	5	6	8	10
1	0.05	0.02									
2	0.14	0.05	0.02								
3	0.32	0.09	0.04								
4	0.53	0.16	0.09	0.02							
5	0.80	0.25	0.12	0.04							
6	1.13	0.35	0.18	0.07	0.02						
7	1.52	0.46	0.23	0.08	0.02						
8	1.93	0.58	0.30	0.10	0.04						
9	2.42	0.71	0.37	0.12	0.05						
10	2.92	0.87	0.46	0.16	0.07	0.02					
11	3.50	1.04	0.53	0.18	0.07	0.02					
12	4.09	1.22	0.64	0.20	0.09	0.02					
14	5.45	1.63	0.85	0.28	0.12	0.04					
16	7.00	2.09	1.08	0.37	0.14	0.04					
18	8.69	2.60	1.33	0.46	0.18	0.07					
20	10.6	3.15	1.63	0.55	0.21	0.09	0.02				
22	12.6	3.77	1.96	0.67	0.25	0.10	0.02				
24	14.8	4.42	2.32	0.78	0.30	0.12	0.04				
26	17.2	5.13	2.65	0.90	0.35	0.14	0.05				
28	19.7	5.89	3.04	1.04	0.41	0.16	0.05				
30	22.4	6.70	3.45	1.17	0.43	0.18	0.05				
35		8.90	4.64	1.56	0.62	0.23	0.07				
40		11.4	5.89	1.98	0.78	0.30	0.09	0.02			
45		14.2	7.34	2.48	0.97	0.37	0.12	0.04			
50		17.2	8.92	3.01	1.20	0.46	0.14	0.04			
55		20.5	10.6	3.59	1.43	0.55	0.16	0.05			
60		24.1	12.5	4.21	1.66	0.64	0.18	0.07	0.02		
70			16.6	5.61	2.21	0.85	0.25	0.09	0.03		
80			21.3	7.18	2.83	1.08	0.32	0.12	0.04		
90				8.92	3.52	1.36	0.39	0.14	0.07		
100				10.9	4.28	1.66	0.48	0.18	0.07	0.02	
150				23.2	9.06	3.50	1.04	0.37	0.16	0.05	
200					15.5	5.96	1.75	0.62	0.28	0.07	0.02
250					23.4	9.05	2.65	0.94	0.42	0.12	0.05
300						12.6	3.73	1.34	0.58	0.16	0.05
350						16.8	4.95	1.78	0.76	0.21	0.07
400						21.5	6.33	2.25	0.97	0.28	0.10
450							7.87	2.81	1.20	0.32	0.12
500							9.55	3.41	1.45	0.42	0.14
550							11.4	4.07	1.75	0.48	0.16
600							13.4	4.78	2.05	0.58	0.18
650							15.5	5.54	2.37	0.67	0.23
700							17.8	6.37	2.71	0.76	0.25
750							20.3	7.22	3.10	0.86	0.30
800								8.14	3.50	0.97	0.32
850								9.11	3.89	1.08	0.37
900								10.1	4.32	1.20	0.42
950								10.8	4.79	1.34	0.46
1000								12.3	5.27	1.45	0.51

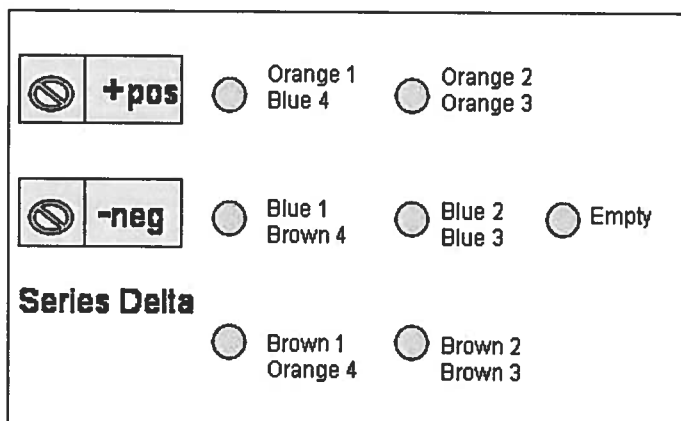
#1 Parallel Delta



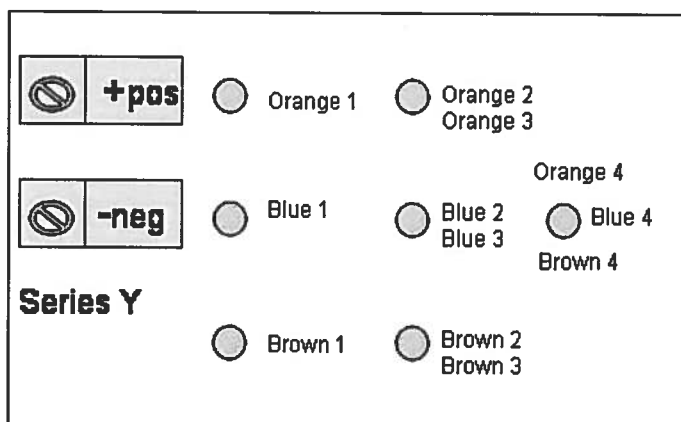
#2 Parallel Y



#3 Series Delta



#4 Series Y



Wiring Diagrams

These diagrams represent the four possible combinations of output wiring.

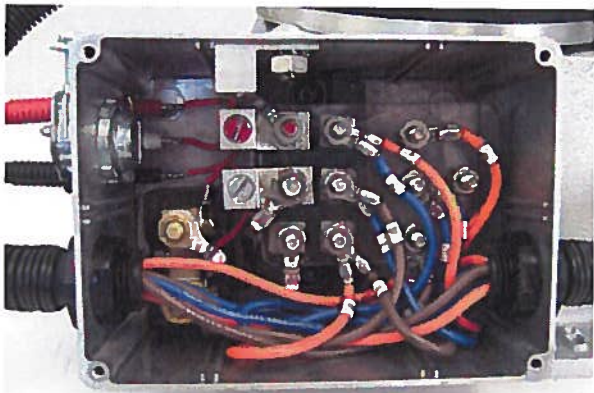
If you find your air gap adjustment to be at a minimum and wish to try for more power, then try using the next higher combination.

If you find the air gap is very large, try the next lower one.

Note that there is only a small change between #2 (Parallel Y), to #3 (Series Delta).

There is a ground lug on the junction box for grounding the machine.

The negative output is on the terminal block and is isolated.



example of series delta wiring

WIRING SCHEMES

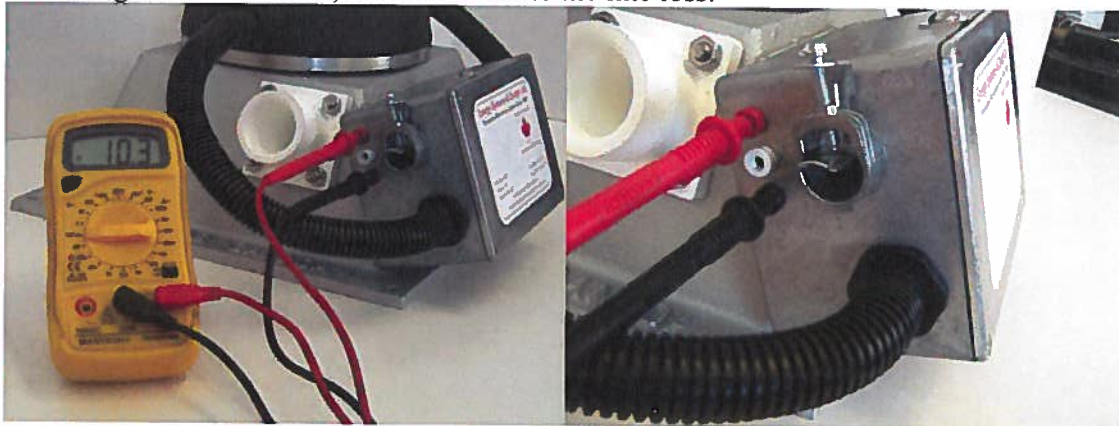
<i>12 VOLTS</i>	<i>24 VOLTS</i>	<i>48 VOLTS</i>
Parallel Delta All Heads	Series Delta <i>up to 60' / 18 m</i>	Series Y <i>up to 60' / 18m</i>
	Parallel Delta <i>30' / 9m and up</i>	Series Delta <i>30' / 9m to 250' / 75m</i>
		Parallel Delta <i>140' / 43m and up</i>

Note: At a given site, more than one scheme may work. But one will work best.

Parallel wye configuration is not mentioned because it is very similar to series delta. It differs by about 15%. If you have a site where series delta is used and you think the output could be greater, try it. Remember to adjust the rotor for highest output when changing the wiring.

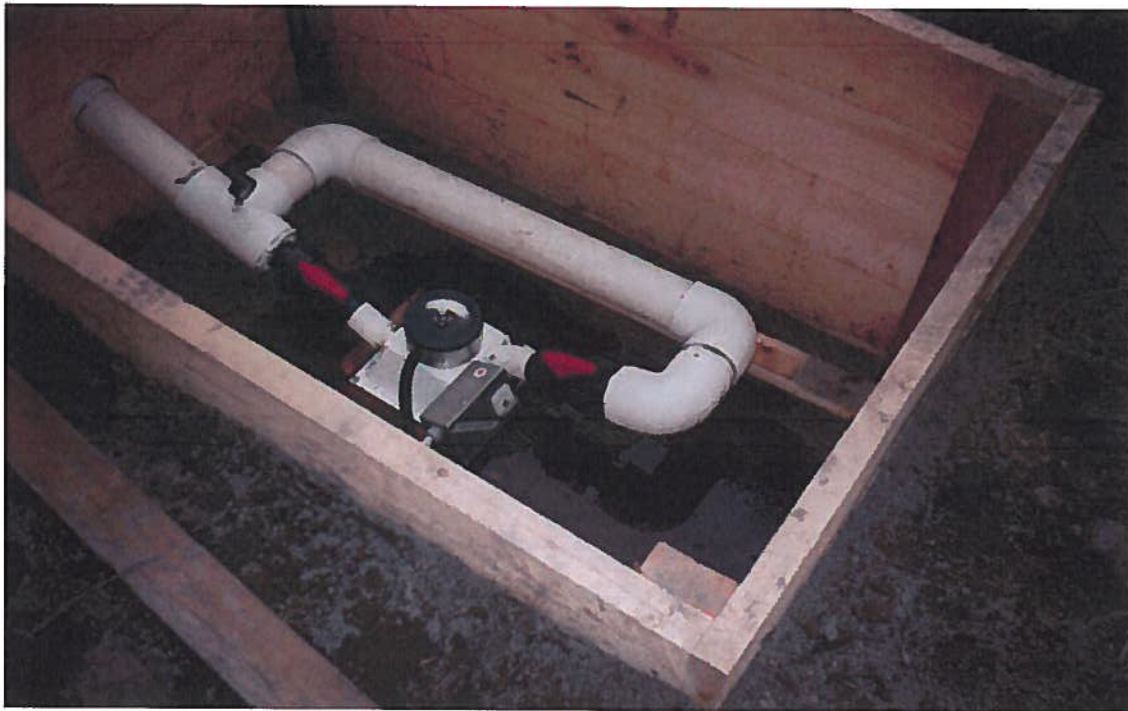
CURRENT MEASUREMENT TECHNIQUE

A built-in shunt is installed in the junction box which allows the current to be measured. This is done with the supplied DMM (digital multi meter). To measure the current produced by the generator, set the DMM scale to "DC milli-volts" or "200 m", which is the nine o'clock position. **Do not use the amps scale.** Plug the leads into their corresponding color-coded jacks on the side of the junction box and the reading will be the generated current. Note also that output voltage can be measured by plugging the red lead into the white jack and using a suitable DC scale on the meter. Compared to the voltage at the batteries, this will indicate the line loss.



INSTALLATION EXAMPLES

A Stream Engine installed using PVC pipe and union valves.



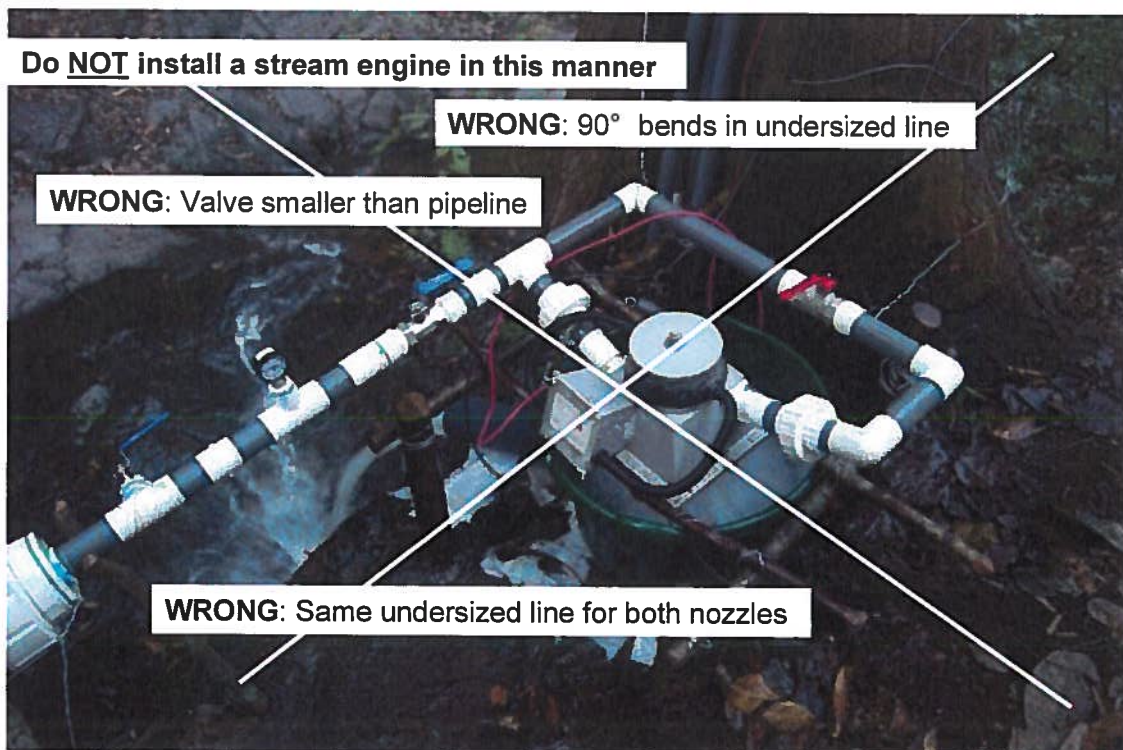
Under construction; a 30' head site shown before gravel base was added.
Installation with flexible pipe. Note the pipe is attached to the nozzles using hose clamps.



Note pressure gauge installed by drilling and tapping the T fitting and using a small valve. This allows removal of the gauge to prevent freezing damage to the gauge.



Following is an example of what **NOT** to do for a Stream Engine installation. An installation of this sort will result in a huge loss of power. To optimize the output of the generator all aspects of installation should be well done. It is important to pay attention to plumbing, nozzle size, intake conditions, siting, electrical components, as well as regular maintenance.



Personal Hydropower

Product Information

Model # _____ Serial # _____
Date Purchased _____
Purchased From _____
Name: _____
Address: _____
City: _____
State/Prov: _____ Zip/Postal Code: _____
Telephone: _____
Email: _____
Comments: _____



Made in Canada

By

Energy Systems and Design Ltd.
PO Box 4557
Sussex NB
Canada E4E 5L7

Phone +1 (506) 433-3151

Fax +1 (506) 433-6151

Email: support@microhydropower.com

Website: www.microhydropower.com

Hemenway, Sandy

From: Barb or Steph [info@maplegrovehotsprings.com]
Sent: Thursday, December 27, 2012 8:21 PM
To: Hemenway, Sandy
Subject: Re: 13-7576 Timmons and Senter, request to reinstate Water Permit

Hi Sandy,

Sorry this is slower response with the holidays and not all info I know. The only one we are having examined by Scheiss & Assoc is the hot water right that lapsed, the others are still ready for the IDWR to examine whenever it is convenient. I am not opposed to getting all of them finished up but did not really make plans to do so. I will answer what I can without research then work on the rest soon... Power

1. The wheel is a Stream Engine from New Brunswick Canada made by Energy Design 2. yes batteries 6 volt deep cycle batteries, 16 of them 3.

4. House is 1400 sq ft approximately and business building about 30x40 5. Appliances... 2 refrigerators, gas forced air furnace, computer, chest freezer, microwave, lighting, 2 water pumps, one septic lift pump, phone booster equipment to get cellular reception. All of the electricity is put in to the batteries and utilized, some electricity is made by solar panels and windmill as well. *1/3/2013 phone conversation w/ Barbara, she described the location of the pelton wheel, solar panels, + house in the trees (NE of pond). (NW of pond).*

Irrigation

The dam is mud and rock with a plastic liner not cement. We run sprinkler heads mounted in 2 inch pvc lines to sprinkle the lawn area. The water is piped in a 4 inch line before the sprinklers. *1/3/2013 phone conversation w/ Barbara: misc. size rain birds*

Culinary Spring

I believe a 1 inch line is running down to our cisterns. We use only this drinking spring for drinking, showers and toilets. The spring puts out about 100 gallons an hour. Sorry for any missing info, I will have to ask my ex-husband about some of it. Barb:)

----- Original Message -----

From: "Sandy Hemenway" <Sandy.Hemenway@idwr.idaho.gov>
To: "Barb or Steph" <info@maplegrovehotsprings.com>
Cc: "Sandy Hemenway" <Sandy.Hemenway@idwr.idaho.gov>
Sent: Tuesday, December 18, 2012 2:52:35 PM
Subject: RE: 13-7576 Timmons and Senter, request to reinstate Water Permit

Barb,

Thank you so much for the quick response. I really appreciate it.

Now that I'm looking at overlapping water rights (13-7577 Power use, 13-4347 Domestic internal/spring source, and 13-7135 unnamed stream for irrigation use). Can you give me the following information on these water rights:

13-7577 Power:

- (1) Do you have a picture and any additional information on the pelton wheel (size, make/model, serial number)?
- (2) Do you have any type of power storage (batteries), and if so what volt and how many batteries?
- (3) Is the only water source for the pelton wheel the same 6 inch line off of the hot springs pond, that supplies water to the hot tubs and pool?
- (4) What is the square footage of the residence that is supplied by the pelton wheel?
- (5) What appliances are supplied by this power source?

13--7135 Irrigation Use, from an unnamed stream:

- (1) On the Map (sent on another email), can you mark and identify the point of diversion?
- (2) Can you outline on the map, the place of use that is irrigated by the unnamed stream?

- (3) Can you draw on the map the open ditches, pipe (size and type)?
- (4) If sprinklers are used in addition to gravity flow, what make and size nozzle are the sprinklers, and how many can run at one time?
- (5) Do you know what pressure this system runs at (psi)?
- (6) Is the dam a concrete dam, and if so, do you know what the dimensions are?
- (7) Do you have the ability to measure the flow that is diverted from the dam for irrigation use?

13-7347 Spring source for domestic use (headbox, gravity flow to residence)

- (1) In the notes, it stated that this spring supplied the restrooms and café at the hot tubs and pool. Is this still the case, and if so, what type and size of pipe goes from the spring to there?
- (2) What is the water source for the restrooms and café at the hot tubs and pool?

I know it's a lot of questions, but I really appreciate all your help so we can complete your water rights. If you have any questions, please give me a call.

Thanks,

Sandy Hemenway
(208)287-4920

-----Original Message-----

From: Barb or Steph [mailto:info@maplegrovehotsprings.com]

Sent: Tuesday, December 18, 2012 2:05 PM

To: Hemenway, Sandy

Subject: Re: 13-7576 Timmons and Senter, request to reinstate Water Permit

1. We have about \$8000 a month business, at \$8 each adult and some overnight stays, so between 800- 1000 people a month.

2&4. Our business opened 5-23-2003. The oldest pool was used every summer as a business from around 1913- 1960. We built the others after our purchase in 1999, first completed 8-10-2000, second was 2001 or 2002, then we opened and built a third tub completed 2008.

3. Original pool was 62x62 feet about and 3 foot -8 foot deep. We cut the pool in half so it is about 31x31 3 foot deep to about 5 foot depth. The other tubs are more round hot tub style 14 foot round waist deep, 12 foot round hip deep, and 16x20 oval also about hip deep.

----- Original Message -----

From: "Sandy Hemenway" <Sandy.Hemenway@idwr.idaho.gov>

To: info@maplegrovehotsprings.com

Cc: "Sandy Hemenway" <Sandy.Hemenway@idwr.idaho.gov>

Sent: Tuesday, December 18, 2012 12:43:52 PM

Subject: 13-7576 Timmons and Senter, request to reinstate Water Permit

Dear Barbara,

I am currently conducting the review to reinstate the water permit 13-7576. Reviewing the beneficial use field examination that was conducted on 8/23 / 2012, there are a few questions that I have about the system:

- (1) How many people use the hot tubs/pool per day or per year?

(2) Do you have any records that indicate historical use of the hot tubs and pool i.e. customer use records, receipts from being constructed, dated pictures, etc. ? Anything that will confirm beneficial use as far back as possible.

(3) What is the dimensions of each of the hot tubs (diameter, depth), and pool (length, width, depth)?

(4) When were the hot tubs and pool constructed and completed?

Please get back with me within 14 days, with the information requested above. Historical records can be scanned and sent as an email attachment or mailed, whichever is easiest.

Thanks,

Sandy Hemenway

Sr. Water Resource Agent
IDWR/State Office
PO Box 83720 or 322 E. Front St.
Boise, ID 83720-0098
OFFICE: (208) 287-4920
CELL: (208) 761-0280
FAX: (208) 287-6700
Email: sandy.hemenway@idwr.idaho.gov

Maple Grove Hot Springs



Located on the Bear River at the north end of the Oneida Narrows Reservoir in Southeast Idaho. Natural hot springs mineral water flows through continuously so no chemicals are needed in the 4 relaxing pools. Open 7 days a week from 10am-10pm. To get here take Hwy 34 from Preston 21 miles north or 15 miles south from Grace and turn on 13800 N Rd (at the blue hwy sign) then take an immediate right on Maple Grove Rd, follow that south 3 miles stay right at Y. Please note Preston and Grace are really your last stop to buy gas and/or groceries, we sell some snacks, drinks and ice, but not significant healthy food or gas.

Visit for just the day or stay overnight in one of our vintage trailers, Lakeside Hideaway house, or a campsite which can be reserved ahead of time individually or in groups for family reunions and parties. Outside food and drink are welcome but glass is not! If you bring items in glass you will need to transfer them to plastic or metal in the kitchen.

There is a lot of recreation here in the canyon besides the pools. In the summer the reservoir is used for fishing (wall eye and small mouth bass) waterskiing, pwc, canoes, and kayaks. The dirt roads are quiet enough to walk or ride bikes and you can follow a gametrail up the hill for a nature hike. In the winter you can cross country ski or snow shoe the unplowed roads or walk the plowed and enjoy the trumpeter swans that winter here; or you can just relax in a pool and stargaze or watch for wildlife.

[follow us on facebook](#) often we mention special discounts and the most current info on our facebook page.

[Directions by Google Maps](#)

[Home](#) [Stay Overnight](#) [Photos](#)
[Rates](#) [Contact Us](#)



Content blocked

We will be closed Wed October 24th for fall maintenance, reopening regular hours Thursday the 25th.

Big square pool cleaning dates for 2012:

January 3, 17 & 31

February 14 & 28

March 13 & 27

April 10 & 24

May 8 & 22

June 5 & 19

July 3, 17 & 31

August 14 & 28

September 11 & 25

October 9 & 23

November 6 & 20

December 4 & 18



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Maple Grove Hot Springs

Home Stay Overnight Photos
Rates Contact Us

Rates all include tax

Day soak 10am-10pm unlimited re-entry that day

adult (13 & up) \$8 (7.52 + .48tax)

seniors (65 & up) \$7 (6.58 + .42 tax)

child (3-12) \$5 (4.70 + .30 tax)

Campsite \$15 (13.80 + 1.20 tax) for spot plus grounds fee of \$10 per adult and \$7 per child

grounds fee entitles use of all facilities including pools, showers, kitchen from arrival to check out- noon of next day.

Detroit trailer \$38 (34.96 + 3.04 tax) plus grounds fee of \$10 per adult and \$7 per child

-Accommodations for four. Additional laundry fee of \$5 per bed if we make the beds or you can bring your own bedding, pillows and blankets.

Spartan trailer \$60(55.20 + 4.80 tax) plus grounds fee of \$10 per adult and \$7 per child

-Accommodations for six. Additional laundry fee of \$5 per bed if we make the beds or you can bring your own bedding, pillows and blankets.

Lakeside Hideaway house \$150 (138 + 12 tax) plus grounds fee of \$10 per adult and \$7 per child

-Accommodations for six(+). The house has 3 bedrooms bedding included, large living room where you could do sleeping bags.

Unlimited soak pass (1 year) \$150

use of pools during normal business hours can also be use as grounds fee when staying overnight.

We accept Visa, Mastercard and Discover

Wednesdays are half price soaking this does not apply to overnight fees.

We do sell snacks, drinks, postcards, handmade lotions & soaps and some convenience items.

We have punchcards available, each adult soak earns a punch (except wednesdays when 2 adults earn one punch) and with 9 punches you get a free adult soak. 2 full price child soaks earns one punch. This means if you use a punchcard every visit your soak comes down to \$7.20 from \$8

Maple Grove Hot Springs

Home

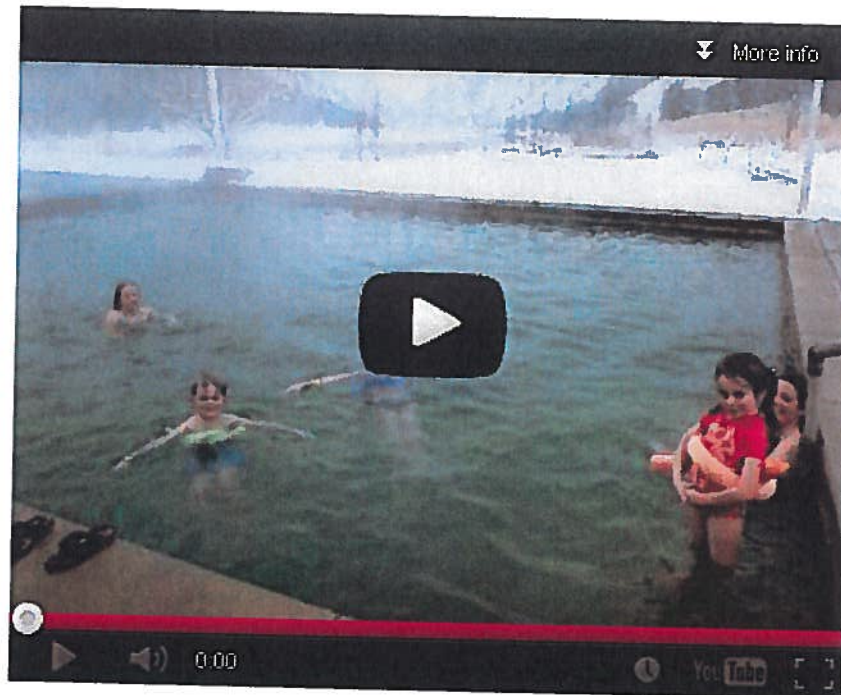
Stay Overnight

Photos

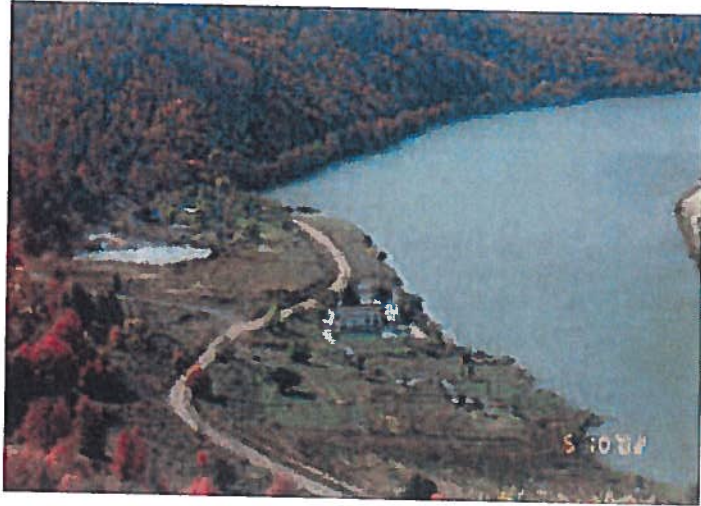
Rates

Contact Us





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Overhead View