

May 17, 2006

RECEIVED

MAY 22 2006

DEPARTMENT OF WATER RESOURCES

To Whom It May Concern:

My wife and I left the busy life of California for the peaceful, quiet Grangeville, Idaho last October 25, 2005, hoping to live in union with nature.

In less than a week after we arrived, we experienced the first snow up on our 4200 feet elevation property barely prepared for the 6-month long winter season. Our northern exposure and the fact that our western part is blocked by a huge mountain ridge did not help to keep us warm.

We discovered that our spring box has been enclosed with treated wood and that our 1200-gallon water tank was full of green algae. We have not stopped buying drinking water since we arrived up to this writing.

We spent our thanksgiving weekend scrubbing the inside of the water tank until it sparkled white again. However, we can still see blue particles floating from our faucet water. It is most likely from the sealant used for the down-spout of the water tank.

Despite our efforts to place water filters in our water tank, kitchen and bathroom sinks and bathroom shower, we are still not comfortable drinking from our water source until we can remedy that treated wood in our spring box or find a clean and safe water source.

Heating the house is another challenge with the heating source coming mainly from propane powered fireplace in the basement and in the main level. This house was not designed in such a way that warm heat can rise directly from below to the master bedroom in the loft, above the main floor.

With the amount of money we spent for propane during this cold season, we find it more efficient to invest on another power source. Thus we decided to obtain license to put up a micro-hydropower system.

Enclosed are pictures of Farrens Creek and the layout of the surrounding terrain near or in the vicinity of the creek. With the very steep slope (please refer to topographical map from Topozone.com), we affirm that there is no fish habitat visible up on our elevation or even on lower elevation as the creek winds down the canyon to the region before the confluence with the South Fork of the Clearwater River, as we have witnessed on many occasions throughout last year (2005) and this year (2006).

This fact is professionally supported by scientific data concluded by fisheries biologist, Katherine Thompson, of Nez Perce National Forest (please refer to her enclosed letter). Nevertheless with the configuration of the canyon, year-round water from all sources

throughout various elevation flows toward that unique canyon to the main river way down below.

It is not our purpose to redirect water from the creek or to endanger the creatures that thrive from the water source. We only intend to make use of the *water pressure* generated from the flow of the creek to supply us with renewable energy source to make our off-the-grid living a little more tolerable especially during seasons of severe climate. We did experience 11 degrees below zero last January.

Farrens Creek is more than 700 feet away from our house and we know that power generated from a micro-hydro electric is cut down immensely by the transmission distance. Other factors that affect proportionately the energy produce are head (drop), and the volume of flow.

Please note that the proposed site has a drop of approximately 30 to 50 feet only. In addition, "water to wire" efficiency factor for small hydropower system is approximately 50 percent (please see enclosed page on How to Plan for a System, page 1 to 3 from www.canren.gc.ca). Therefore, there would be significant reduction in power generated if we were only permitted to utilize a certain percent of the water.

It is a fact that carrying out a survey prior to water rights approval requires a significant investment. It would be so unwise to perform such a survey and to eventually be granted permit for micro-hydro system that cannot produce sufficient energy for the basic needs of our family throughout the year.

It is almost half a year since we apply for license on the micro-hydro system. Yet we can not really have our property surveyed to start the project, until we are granted from authorized agencies the right to put up a micro-hydro system that can produce enough energy to supply our most essential need.

With the facts given above, this plan can be made possible when we are granted license for micro-hydropower system with least or no restriction.

It is our fervent hope that you will consider the human perspective of our survival. We are one in goal in protecting nature and we are willing to make an extra effort to keep it the way the Creator has intend it to be.

Respectfully,


OI MIN ANTHONY CHAI

RECEIVED

MAY 22 2006

May 16, 2006

DEPARTMENT OF WATER RESOURCES

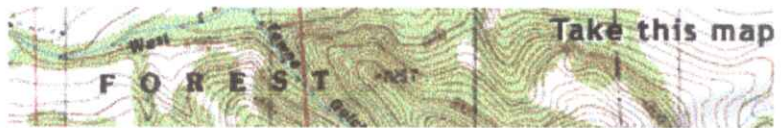
To Whom It May Concern,

A Forest Service fisheries technician and myself electrofished the lower reaches of Farrens Creek immediately above its confluence with the South Fork Clearwater River in early October, 2005. We started just above the confluence and proceeded upstream approximately 100 meters. We did not capture any fish and we did not observe any fish. This stream is isolated from the main river at all but the highest flows and is in general too small and too steep to support a population of fish. I am aware of an anecdotal observation of one fish made at or near the mouth of the stream in early fall 2005, but we were unable to document the presence of any fish in this area in 2005 using an electrofisher.

We did not survey any areas farther upstream, and I have not seen any area of the watershed except the very lowest reaches on Forest Service lands.

Katherine Thompson
Fisheries Biologist
Nez Perce National Forest
(208)983-1950

topozone

[VIEW MAPS](#)[GET DATA](#)[MY TOPOZONE](#)[WEB SERVICES](#)[ABOUT US](#)[Map/Photo Info](#)[Topo Download](#)[Photo Download](#)**USGS Topo Maps**☒ 1:24K/25K Series☐ 1:100K Series☐ 1:250K Series**Map Size**☐ Small☐ Medium☒ Large**View Scale**

1 : 50,000

[Update Map](#)**Coordinate Format**

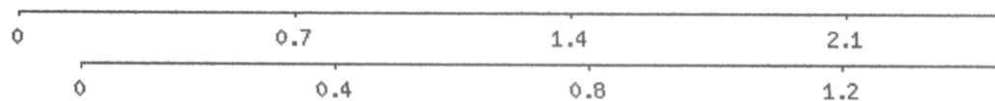
UTM

Coordinate Datum

WGS84/NAD83

☒ Show target[Email this map](#)[Bookmark this map](#)[Print this map](#)**myTopo.com****GET A
CUSTOM
MAP PRINT**

UTM 11 575039E 5080663N (WGS84)

USGS **Grangeville East (ID)** Topo MView *TopoZone Pro* aerial photos, shaded relief, street maps, interact

Natural Resources
CanadaRessources naturelles
Canada

Canada

RECEIVED

MAY 22 2006

DEPARTMENT OF WATER RESOURCES

Français	Contact Us	Help	Search	Canada Site
Home	What's New	About Us	Site Map	NRCan Site

(Using CanREN) (Energy Solutions) (Technologies & Applications)
 (Renewable Energy in Action) (Resource Assessment) (Programs)
 (Publications & Software) (Youth & Educational Material) (Glossary) (Links & Networking)

CanREN

Publications & Software

Publications & Software



○ Products

○ General Publications

○ Bioenergy

○ Earth Energy

● Hydroelectric Energy

● Micro-Hydropower Systems - A Buyer's Guide

- [About this Guide](#)
- [What is Micro-Hydropower?](#)
- [How to Plan for a System](#)
- [Basic Components of a Micro-Hydropower System](#)
- [Choosing a System](#)
- [Economics](#)
- [Buying a Micro-Hydropower System](#)
- [Installing, Operating and Maintaining a System](#)
- [Further Information](#)
- [Appendix A](#)
- [Appendix B](#)
- [Appendix C](#)
- [Appendix D](#)
- [Glossary of Terms and Abbreviations](#)
- [Bibliography](#)
- [Useful Web Sites](#)
- [Reader Survey](#)

○ Solar Energy

How to Plan for a System

If you are thinking seriously about installing a micro-hydropower system, you will want to plan a system that is sure to meet your energy and power needs. There are also various planning stages that you will need to consider. Once these initial steps are completed, you can begin preliminary system design. Many factors contribute to a successful micro-hydropower system.

How to Measure Potential Power and Energy

The first step is to determine the hydro potential of water flowing from the river or stream. You will need to know the **flow rate** of the water and the **head** through which the water can fall, as defined in the following:

- The **flow rate** is the quantity of water flowing past a point at a given time. Typical units used for flow rate are cubic metres per second (m^3/s), litres per second (lps), gallons per minute (gpm) and cubic feet per minute (cfm).
- The **head** is the vertical height in metres (m) or feet (ft.) from the level where the water enters the intake pipe (penstock) to the level where the water leaves the turbine housing (see Figure 5).

See [Appendix A](#) for ways to measure the head and stream flow rate.

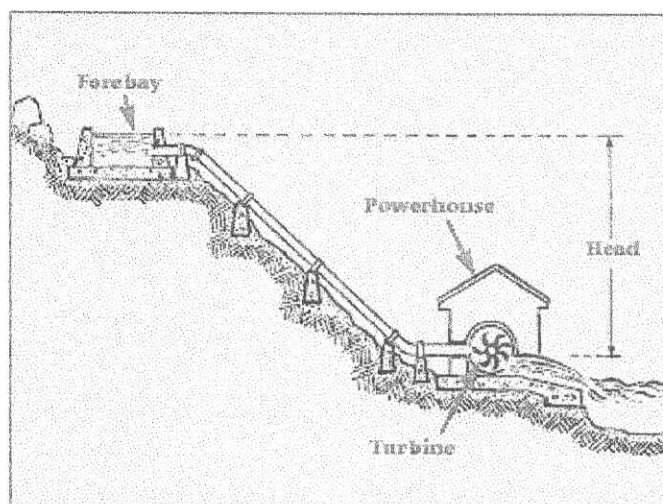


Figure 5. Head of a micro-hydropower system

○ Wind Energy

Power calculation

The amount of power available from a micro-hydropower system is directly related to the flow rate, head and the force of gravity. Once you have determined the usable flow rate (the amount of flow you can divert for power generation) and the available head for your particular site, you can calculate the amount of electrical power you can expect to generate. This is calculated using the following equation:

$$P_{th} = Q \times H \times g$$

P_{th} = Theoretical power output in kW

Q = Usable flow rate in m^3/s

H = Gross head in m

g = Gravitational constant ($9.8 m/s^2$)

Example 1

A site has a head of 10 m (33 ft.) with flow of $0.3 m^3/s$ (636 cfm or 4755 gpm); therefore, the potential power output is given by $Q \times H \times g$ ($0.3 \times 10 \times 9.8$), which is 29.4 kW.

This is only the theoretical available power, assuming that 100 percent of the power available in the water can be usefully converted. Efficiency of the system also needs to be taken into account. Energy is always lost when converted from one form to another, and all of the equipment used to convert the power available in the flowing water to electrical power is less than 100 percent efficient. To calculate the most realistic power output from your site, you must take into account the friction losses in the penstock pipes and the efficiency of the turbine and generator.

When determining the head, you will need to consider **gross head** and **net head**. Gross head is the vertical distance between the top of the penstock that conveys the water under pressure and the point where the water discharges from the turbine. Net head is the available head after subtracting the head loss due to friction in the penstock from the total (gross) head (net head = gross head - losses in the penstock).

Small water turbines rarely have efficiencies better than 80 percent. Potential power will also be lost in the penstock pipe that carries the water to the turbine because of frictional losses. Through careful design, however, this loss can be reduced to a small percentage; normally, the losses can be kept to 5 to 10 percent. Typically, overall efficiencies for electrical generation systems can vary from 50 to 70 percent, with higher overall efficiencies occurring in high-head systems. Generally, overall efficiencies are also lower for smaller systems. As a rule, the "water to wire" efficiency factor for small systems (for example, up to 10 kW) could be taken as approximately 50 percent; for larger systems (larger than 10 kW) the efficiency factor is generally from 60 to 70 percent. Therefore, to determine a realistic power output, the theoretical power must be multiplied by an efficiency factor of 0.5 to 0.7, depending on the capacity and type of system.

$$P = Q \times H \times g \times e$$

e = efficiency factor (0.5 to 0.7)

$$\text{Power output (in watts)} = Q \text{ (lps)} \times H \text{ (m)} \times g \times e$$

Example 2

A turbine generator set to operate at a head of 10 m (33 ft.) with flow of $0.3 m^3/s$ (636 cfm) will deliver approximately 15 kW of electricity. This is given by P

$= Q (0.3) \times H (10) \times g (9.8) \times e (0.5) = 14.7 \text{ kW}$, assuming an overall system efficiency of 50 percent.

These calculations will give you an idea of how much power you can obtain from your water resource. Table 1 shows how much electrical power you can expect with various heads and water-flow rates.

Table 1. Typical Power Output (in Watts) With Various Head and Water-Flow Rates

		Flow Rate										
Head		(lps)	5	10	15	20	40	60	80	100	150	200
		(ft.)	(gpm)	7.9	15.9	23.8	31.7	63.4	95.1	126.8	158.5	211.0
1	3		25	49	74	98	196	294	392	490	735	980
2	7		49	98	147	196	392	588	784	980	1470	1960
4	13		98	196	294	392	784	1176	1568	1960	2940	3920
8	25		196	392	588	784	1568	2352	3136	3920	5880	7840
10	33		245	490	735	980	1960	2940	3920	4900	7350	9800
15	49		368	735	1103	1470	2940	4410	5880	7350	11030	14700
20	66		490	980	1470	1960	3920	5880	7840	9800	14700	19600
30	98		735	1470	2205	2940	5880	8820	11760	14700	22050	29400
40	131		980	1960	2940	3920	7840	11760	15680	19600	29400	39200
60	197		1470	2940	4410	5880	11760	17640	23520	29400	44100	58800
80	262		1960	3920	5880	7840	15680	23520	31360	39200	58800	78400
90	295		2205	4410	6615	8820	17640	26460	35280	44100	66150	88200
100	328		2450	4900	7350	9800	19600	29400	39200	49000	73500	98000

top

Flow Duration Curve and Energy Calculations

As an owner/developer of a potential hydro site, you may wonder how much power your site will produce. A more exact question is how much energy it will produce - it is energy in kilowatt hours (kWh) that we buy from or sell to the electricity supplier. Energy is a measure of the length of time we have used or produced a given amount of power. For example, if you use 1 kW (1000 W) of electricity for one hour, you have used 1 kWh of electrical energy. A site on a stream or river that has a highly variable flow (i.e., a wide range of flows with many highs and lows) may not produce as much energy as a river that has a smaller range of flows but that is more consistent on average. A hydrologist or professional consultant can produce a flow duration curve (FDC) for a river or stream by ordering the recorded water flows from maximum to minimum flow (as shown in Figures 6a and 6b). This is a way to show the probability in graph form of how many days in a year a particular flow will be exceeded. (The area below the curve is a measure of the energy potential of the river or stream.)

The FDC is used to assess the expected availability of flow over time and the power and energy at a site and to decide on the "design flow" in order to select the turbine. Decisions can also be made on how large a generating unit should be. If a system is to be independent of any other energy or utility backup, the design flow should be the flow that is available 95 percent of the time or more. Therefore, a stand-alone system such as a micro-hydropower system should be designed according to the flow that is available year-round; this is usually

RECEIVED

MAY 22 2006

DEPARTMENT OF WATER RESOURCES



Picture taken February 25, 2006 : Farrens Creek, actual creek for hydropower proposal during winter - site of turbine.

Creek flows down indicated by the red mark
as the road winds to the right.



Farrows Creek passing through a road just before
a loop - approximately 30-50 feet.



Aerial view above the creek showing direction of water from all sources flowing through a canyon path.



Another view of the water flow as the creek drops.



Gentle slope terrain with water from all sources collecting down towards the creek.



Site of an undeveloped spring a few feet above the creek.



Neighbor's house above with a well of water & 2 springs. Farren's creek below.



Another way towards the creek, still quite a distance but the shortest route from our house.



House above the creek with 300 - 500 feet
water well and 2 spring sites flowing towards
the steep canyon.



Another view of steep canyon north side from
the creek.

