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By Email: EHendriks@WWFCanada.org

Re: Backgrounder for our Meeting

Dear Liz:

First, it is important to note that there are literally thousands of old and unsafe dams scattered across Ontario that should be removed rather than retrofitted to produce power. Dam removal brings a variety of benefits to local communities, including restoring water quality and river health, it opens up and revitalizes habitat and fish populations, improves public safety and recreation, reduces methane emissions, enhances local economies, and builds stream resilience to help withstand a warming climate.

The Ontario Rivers Alliance (ORA) is a grassroots fully volunteer organization with a mission to protect, conserve and restore Ontario rivers. Our work has resulted in the removal of 5 and soon to be 7 dams since 2014. It is a slow and laborious process, but the ecosystem benefits are enormous!

The ORA and its members worked several years to address numerous waterpower proposals in the last green energy rush. Many of these proponents bucked policy and legislation and downplayed the environmental effects to maximize power generation at the expense of riverine ecosystems. One proponent proposed clean, green and renewable hydroelectric projects that would dam and/or flood rapids and waterfalls at 19 sites. One of their projects went to a Final Environmental Report 3 times without success because their studies were so lacking, and we successfully challenged them with Part II Order requests. The Director of Approvals at Ministry of Environment (MOE) actually invited the ORA to their head office to thank us for intervening as it gave them the opportunity to send the proponent back to do more studies. Eventually, the proponent ran out of money, spending $42 Million of OP Trust pension funds. That is how we managed to stop 24 projects on 12 Ontario rivers. Out of 26 hydroelectric projects we were able to challenge in that first wave, only 2 received MOE approval.

It is daunting to look ahead at what now could be another wave, because this time our hands will be tied. There will be no opportunity to offer input or mitigation recommendations or to file a Part II Order request because all of those options are now off the table.

It is challenging to understand the logic of a November 2021 CBC article that reports, "*The Nature Conservancy and the World Wildlife Fund are two environmental groups that oppose new hydro dams because they can block fish migration, harm water quality, damage surrounding ecosystems and release methane and CO_2. But they say adding turbines to non-powered dams can be part of a shift toward low-impact hydro projects that can support expansion of solar and wind power.*" Whether it's a new dam or an older retrofitted dam, they will result in the same negative impacts and produce the same amount of methane for 70 to 100 years or more.

The article then goes on to quote Paul Norris, president of the Ontario Waterpower Association (OWA) in agreement, saying "*Any time that you can better use existing assets is a good thing.*" In Ontario, about 1,000 unpowered dams are owned by various levels of government. *"With the appropriate policy framework, many of these assets have the potential to be retrofitted for small hydro."* [1] The OWA has consistently worked to remove any barriers to waterpower development, and they have found great success with this current provincial government. There are vast differences between a fixed dam and one with turbine/s chopping up fish, pulsing water levels and flows, and with no environmental assessment or public consultation.

When high profile environmental organizations such as the WWF-Canada offer their approval and support for hydroelectric, it provides validation and support to the Ontario Waterpower Association, Hydro Canada, International Hydropower Association, World Hydropower Association, etc... All hydro associations represent waterpower proponents that are labeling it clean and renewable. It sends a powerful message to the public that if WWF-Canada supports it, well it must be okay.

After reviewing several WWF-Canada reports, as well as its website, it is apparent that your organization is cognizant of some of the ongoing cumulative effects resulting from large hydroelectric, but maybe not so much with the effects of small hydro and their headponds.

Perhaps it would be best to address the statements made by WWF and provide the rationale behind our concerns.

WWF-Canada Rationale:

The WWF-Canada website goes so far as to suggest that "*Switching to renewables <u>will eliminate emissions</u>, causing climate breakdown while reducing related impacts such as forest fires, melting Arctic ice, sea-level rise, desertification, erosion and flooding*."[2]

It is very misleading to claim that switching to renewables will eliminate emissions or is habitat-friendly, but I will address this frequent misrepresentation of the facts shortly.

WWF-Canada also acknowledges that "*these infrastructure changes [dams] can have negative impacts on wildlife and their habitats*", yet "*supports the transition to habitat-friendly renewable energy projects that consider the needs of both wildlife and communities*". "*If renewable energy project planning and development fails to account for biodiversity, migratory patterns or sensitive habitats, they can have major — and sometimes irreparable — consequences on wildlife.*"

The Minister of Energy has just ordered Ontario Power Generation to work with the OWA to assess the waterpower potential in the North.[3] The OWA has already identified thousands of potential sites (>1MW to >100 MW) in a 2013 Northern Hydro Assessment Waterpower Potential in the Far North of Ontario, so I doubt there is anything more to assess.

The WWF-Canada document, Connected and Flowing; A Renewable Future for Rivers, Climate and People, will open the flood gates for hydroelectric projects on smaller rivers around the world. The hydropower industry has been lobbying hard for a new renaissance in hydroelectric because, as the the report noted, "*Capacity additions of hydropower have been declining since 2013, due not only to the falling costs of competing technologies, but also to a broader set of challenges, including high-profile cancellations, growing hydrological risks, cost and schedule over-runs, technical challenges, and increasing social resistance*."

We are in agreement there, and it has been our experience that hydroelectric projects when done correctly take years to go through the environmental assessment and approvals process, constructions costs are usually double the estimates, and they are very unpopular with stakeholders, Indigenous communities and the public, contrary to what the OWA claims.

The report's definition and vision for "low-impact hydropower" is very troubling in that it states, "*low-impact hydropower plants that provide storage capabilities and flexibility have a strong role to play in backing up variable sources, such as solar and wind, and providing the ancillary services that contribute to grid stability. Low impact hydropower could still be an important component of the world's transition to deploying more intermittent renewable energies*"[4].

This is all wrong, and I will explain why:

Low-impact Hydropower is Run-of-River:

The only lower-impact type of hydroelectric power generation is run-of-river, but it has no storage capacity. In fact, building a true run-of-river facility is often not cost-effective on smaller rivers because of the high cost of construction, and the small amount of intermittent power that would be produced as a result of low and unreliable flows – as low as 15 to 30% of Installed Capacity[5].

The daily, seasonal and annual variations of small hydro operations are intermittent and therefore not reliable. This is because generation peaks during the high flows of spring when power is in low demand and produces at its lowest during the hot summer months when consumption and demand are highest. During the low flow season of summer or during drought conditions many true run-of-river and even some peaking (storage) facilities, especially on smaller rivers, cannot operate efficiently, and often have to be shut down.

To further highlight this point, in 2014 an analysis was conducted by the Independent Electricity Systems Operator (IESO) to determine the best means of connection to remote First Nation communities, and to enable forecasted growth to the Ring of Fire. The analysis concluded that "*Northern hydroelectric generation is an energy limited resource known to have significantly reduced output and availability during drought conditions of the river system supplying these generating units.*[6] In fact the recommendation of this report was to <u>not</u> build any new hydroelectric facilities, but primarily build new transmission lines. A cost/benefit analysis would be necessary to determine whether these types of projects are environmentally and/or economically viable.

WWF-Canada's reports refer to "*low-impact hydropower plants that provide storage capabilities and flexibility".* In fact, these are the types of power dams that carry the heaviest negative toll on riverine ecosystems.

How storage works:

In order to maximize power generation on smaller rivers during peak demand hours, waterpower facilities will create a reservoir or headpond (impoundment) above the dam to increase the head and provide storage. Even with small waterpower projects, the headpond can flood many hectares of land, including wetlands, extend for several kilometers upstream, and impact many more kilometers of downstream riverine ecosystem. To further maximize the power production from a river, multiple cascading waterpower facilities are often constructed, and can involve additional upstream reservoirs.

It is not just as simple as the consideration of storage, but how that storage is used and how much flow is allowed into the downstream. Smaller rivers require storage to produce power when it is in demand, but it has been our experience that to meet demand they use peaking operations with variable flow discharge and ramping patterns. Regulating the rate and frequency of water level changes and the amount of time the station is at its maximum discharge level can all have a significant impact on the degree of channel and bank erosion. While they are holding water back into storage the environmental flows into the downstream are often at a very minimum so they can meet that next peak demand.

The collateral environmental damage caused by these types of hydroelectric facilities has been well documented for decades[7], including the loss or serious decline in migratory fish species (waterpower facilities are key factors in the listing of some iconic fish species as species at risk in Ontario and elsewhere); declining biodiversity[8,9,10,11,12], impaired water quality (including elevation of mercury concentrations in fish tissue); and are key threats to imperiled aquatic species.[13,14] Significant ecological damage from waterpower has been ongoing for many decades in Ontario[15,16,17] and in other locations throughout the world.[18] In the past, attempts to effectively mitigate many of these impacts have been sporadic to non-existent in Ontario.

To emphasize this point, there are 241 hydroelectric facilities in Ontario and only 3 have provided fish passage.

Whether the impoundment is large or small, flooding can destroy or significantly alter some of the most ecologically sensitive areas along the river, including wetlands, riparian zones, and spawning beds. Added together, the cumulative effects on the environment and ecology of a catchment can be substantial.

There are numerous direct and indirect environmental, aesthetic, and socio-economic impacts of silt, suspended sediments and associated turbidity. These include changes to water quality, reduced light penetration, diminished recreational values and aesthetics, as well as direct and indirect impacts to fish, invertebrates and aquatic plants.[19]

Greenhouse Gas Emissions:

The frequent claim by governments and industry is that waterpower produces green and clean energy. It is understood in most circles to mean that it does not emit greenhouse gases (GHGs). "*With the "green" reputation of large hydroelectric dams already in question, scientists are reporting that millions of smaller dams on rivers around the world make an important contribution to the greenhouse gases linked to global climate change*. *Their study, showing that more methane than previously believed bubbles out of the water behind small dams….*"[20] For instance,

> *With smaller dams, storage becomes increasingly important. Reservoirs silting up or becoming overloaded with nutrients are common problems with major reservoirs and could*

be at least as serious where shallower bodies of water are created – the shallower a water body, the more easily eutrophic it can become. Likewise, methane generation occurs largely where water and sediment meet, and this means that a shallower water body is likely to release more methane [CH_4] per unit area than a deeper water body. Shallow reservoirs are not unlike paddy fields which are known to contribute substantially to methane emissions…..[21]

Methane is a potent greenhouse gas with a heat trapping capacity 34 times greater than that of carbon dioxide on a 100 year time scale.[22] Methane is generated in reservoirs from bacteria living in oxygen-starved environments. *"These microbes eat organic carbon from plants for energy, just like people and other animals, but instead of breathing out carbon dioxide, they breathe out methane."* [23] River networks with high nutrient and sediment loading from agricultural or wastewater effluent provides microbial communities with a large source of carbon that can deplete sediment oxygen and fuel methane production. Algal blooms from excessive nutrient loading can further enrich reservoir sediments.[24]

It is also worth noting that these hydroelectric dams will generate power for 100 years or more, so we are talking about many, many billions of tonnes of GHG emissions. In fact, there is so much sediment that builds up in the headponds behind these old mill pond dams that they eventually turn into large wetlands over time.

Flooding landscapes to create reservoirs causes flooded vegetation and soils to decompose, and for sediment to accumulate behind the dam, resulting in net emissions of the GHGs, carbon dioxide (CO_2), and methane into the atmosphere for decades and possibly centuries.[25,26] New reservoir flooding also accelerates the bioaccumulation of methylmercury in fish tissue, and these effects can persist for 20 to 30 years or more. [27,28]

A 2016 study found that even in boreal regions, rotting vegetation and nutrients in the water means that the dams emit about a billion tonnes of greenhouse gases every year. This represents 1.3% of total annual anthropogenic (human-caused) global emissions.[29] Emily Stanley, a professor in limnology and marine science at the University of Wisconsin-Madison, said that the study is "very relevant" because it delivers the best available information about greenhouse gas emissions from dams. It shows that high methane emissions are not linked to the location or antiquity of the reservoirs, as other researchers suggest, but to the quantity of organic material.[30]

Canada relies heavily on hydroelectric power generation at 59.5% of the energy mix, Ontario 23%, BC 91%, Manitoba 97%, Saskatchewan 20%, New Brunswick 21% and Quebec 95%. No wonder there is no appetite to recognize the GHG emissions coming from this energy source when there are a multitude of studies suggesting that this should be taken into account, especially when carbon credits are being considered – hydro needs to pay for their GHG emissions.

At 95% of the energy mix, Hydro Quebec has done a lot worldwide to downplay the amount of GHG emissions coming from its hydroelectric reservoirs. There is a 2011 Montreal Gazette article, Hydro Power's Dirty Side, that was very damming for Hydro Quebec. Fortunately, ORA posted this article on our website shortly after it appeared - there was no longer any sign of it on the web. I advise reading the entire article, but this snippet is important,

Hydro-Quebec hired Duchemin and several colleagues about 10 years ago to study greenhouse gas emissions in their reservoirs. He said Hydro-Quebec refused to publish his data when it showed a lot more greenhouse gases than the utility was prepared to admit to.

In 2006, Duchemin and his colleagues went ahead and published their own paper in the Journal on Lakes and Reservoirs.[31]

However, Hydro Quebec overcame this problem by hiring their own in-house scientist, Alain Tremblay, PhD in Environmental Scientist, Hydro Quebec, Environment. His publications severely downplay the GHG emissions and other related impacts from Hydro Quebec's reservoirs. They are often cited in literature relating to GHG emissions from hydroelectric reservoirs. ORA relies on independent, arms-length studies, rather than studies by employees of a powerful for-profit corporation.

Conclusion:

While the significant potential for environmental and social impacts of waterpower have been known for decades, some argue that waterpower is beneficial as it makes a significant contribution towards reducing the world's dependence on fossil fuels, it is able to store and produce power for peak demand, has a short capital investment payback, and can have a long lifespan of 70 to 100 years. Unfortunately, this argument has led to substantial, and usually unnecessary trade-offs in favour of unmitigated waterpower.[32]

The benefits of waterpower must be weighed in the context of the significant costs to the environment, to biodiversity, it's contribution to climate change, and to the ecological, social, cultural and natural heritage values. It is rare that these trade-offs are fully and transparently examined, reported, or understood by the public.

The extremes of climate change by way of drought, flooding and wildfires will only amplify the environmental and public safety risks of hydroelectric dams.

Instead of increasing their numbers, ORA is requesting that WWF-Canada publicly withdraw its support for retrofitting existing dams with turbines. Instead, join ORA in educating governments and the public on the numerous negative effects of hydroelectric power generation, including its GHGs, and help ensure these emissions are properly assessed and allotted. Finally, the WWF-Canada could join ORA in advocating for the removal of old and unsafe dams.

I look forward to our meeting tomorrow!

Respectfully,

L. Heron

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