Run of the River Hydro Scheme Proposals Glen Etive Tributaries

Paddle Sports Impact Assessment

On behalf of:



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1.0 Introduction

1.1 Report Introduction

This document has been produced in response to the submission for planning consent of seven run of the river hydro electric generation schemes in Glen Etive, Highland, Scotland by the Scottish Canoe Association to look at the potential impacts upon recreational paddle sports use of the various tributaries. It is also intended to be used as a document to help assess the merit of consent / refusal of the proposals in the context of recreational paddle sports.

1.2 Development Proposals

The development proposals consist of several independent run of the river hydro schemes by Dickens Hydro Resources Ltd on behalf of the landowner, Dalness Estates. The schemes are all on tributary rivers of the River Etive and are;

- Allt a Chaorainn *
- Allt Fhaolain *
- Allt Charnan
- Allt Ceitlein *
- Allt na Gaoirean
- Allt Mheuran *
- Allt a Bhiorain

The tributary rivers noted above with an asterisk * are those rivers that are used for paddlesports recreation. As will become clear in subsequent sections, the Allt a Chaorainn is the primary river and the one most commonly paddled and has the greatest profile amongst the paddlesports community, both here in Scotland and nationally. This should not however reduce the perceived importance of the other tributaries.

1.3 Methodology

Discussions have been ongoing between representatives of the Scottish Canoe Association and the Developers for over 12 months with the focus of discussions being the Allt a Chaorainn, with an understanding that the principals apply to the other tributary rivers that are used for paddle sports. The same understanding should be applied when reading this document. Much of the detailed information will be focused upon the Allt a Chaorainn but in most instances the same principals will apply to Allt Fhaolain, Allt Ceitlein and Allt Mheuran.



2.0 Paddle Sports Context

2.1 Location

The 4 tributaries which are used for recreational paddle sports are all located within the lower reaches of Glen Etive and after the main section of the River Etive that is used for paddle sports.

The River Etive and its tributaries are some of the most widely recognised rivers in whitewater paddle sports and are considered to be a 'Classic' experience. It is certainly one of the most popular and photographed river trips due to its smooth bedrock geology which creates waterfalls, slides and pools of varying degrees of difficulty along their length. As such they draw enthusiasts from all over the UK and Europe and no whitewater trip to Scotland is complete without ticking off 'The Etive'.



OS base plan with paddle sport sections noted for reference:

1: River Etive (Classic Section) 2: Allt a Chaorainn 3: Alt Fhaolain 4: Allt Ceitlein 5: Allt Mheuran

The River Etive is often used as a paddlers first introduction to a more advanced whitewater environment and usually their first experience of paddling waterfalls. The relatively easy access and open nature of the Glen means that it is easy for paddlers to access the river for inspections, setting of safety, ability to provide instruction and feedback through photo / video. The exact same can be said for the Allt a Chaorainn in a more advanced context. It is 'the next step' and is the perfect partner to the River Etive. Both the River Etive and its tributaries provide this environment at a variety of levels, and importantly, require less water within the river than the majority of other rivers in the country.

As such, Glen Etive is used as the location for many commercial coaches offering advanced water tuition and guiding experiences, with coaches from all over the UK, including London and the South of England, travelling to run annual courses in the Glen. Similarly, University groups from all over the UK make an annual pilgrimage to the Etive, traditionally at Easter, to introduce new paddlers and to advance the skill set of existing paddlers knowing, that whatever the conditions, they will be able to enjoy the opportunities afforded by the River Etive and its tributaries.



2.2 Allt a Chaorainn Description

The impact upon the Allt a Chaorainn is the principal concern for most paddle sport enthusiasts, with the other tributaries explored and used less often and by the more adventurous. The Allt a Chaorainn is much like its big sister the River Etive, with open bedrock waterfalls and slides, but in this case, the gradient is much steeper and the level of both intimidation and technical difficulty is increased. The section of whitewater consists of four 'rapids' each named for ease of reference;

- Speed
- Ecstasy
- Pinball
- Chasm

Photographs of each rapid are provided in Appendix A for reference.

2.2.1 Speed

This slide /waterfall is unique, certainly in Scotland and to our knowledge the UK, in its formation and experience. The red granite bedrock has been smoothed into a deep gutter with a sine curve like profile which gently draws in the paddler before accelerating them to a high speed down the glass like water before bottoming out in the curve. The paddler is then launched from the last part like a ski jumper into a deep pool. Cliff walls to the left and front make the recovery in the pool challenging.

2.2.1 Ecstasy

This long maelstrom of a rapid consists of several short slides, drops, pools and features that make it unique. There are only a handful of comparable rapids in the country and none, in such a wild and spectacular setting.

2.2.1 Pinball

This intimidating and often physically brutal waterfall is unlike any other in Scotland. Only in Norway and the Alps are we aware of similar types of rapid where the paddler commits to a small water fall onto a shallow bedrock slab which then kicks and diverts the paddler right, then left, before spitting them out, hopefully upright, into the pool below.

2.2.1 Chasm

The most intimidating of all of the rapids is saved for last. Here the river drops at an angle into a narrow channel less than 2 metres in width. Confidence and control of fears are required as well as careful orientation of the paddle as it is too wide to fit through normally as the paddler is flushed down the chasm and spewed out into a cauldron like pool with cliffs to the right and front willing to trap the unwary or disoriented paddler. There are only two or three similar rapids in Scotland and all are isolated features.

These four rapids all sit within 20-30m of each other and the whole run can be paddled by an expert paddler in less than 10 minutes. Most groups however will take between 1 and 3 hours to successfully navigate the trip.

The uniqueness and cumulative effect of the rapids are what make this tributary so special and revered. The strength of feeling towards this river within the paddle sport community cannot be stressed strongly enough.



3.0 Development Impact Concerns

3.1 General Concern

The Scottish Canoe Association is the National Governing Body for Canoeing in Scotland and a founding member of British Canoeing. We are a membership organisation comprising around 3200 individual members with a network of affiliated clubs and approved paddlesport providers throughout Scotland. We seek to represent our members' interests within Scotland and support individual and affiliated clubs as well as work to protect, improve and promote responsible access to water in Scotland and care of the environment.

We understand from our membership that the environment plays a large part in the enjoyment of our sport. We therefore have concerns regarding the development proposals in Glen Etive and the relative impacts they may have upon the visual appearance and perception of the Glen as a wild and unspoilt area of natural beauty. Our preference therefore is for the natural environment of Glen Etive to remain unaffected by development.

We understand the pressures of modern society to harness potential energy from our natural resources and the consequential pressures to develop in remote areas. We also understand the development process and that an appropriate level of assessment will be undertaken by professionals to determine the relevant impacts on all aspects of the environment. We trust in that process and in the relevant competent bodies who undertake the analysis and assessment of development proposals and furthermore trust the appropriate decision will be made in regard to the acceptable levels of development impact within the Glen.

3.2 Dialogue with Developer

We were first made aware of the potential development of these run of the river hydro schemes in early summer of 2017. Contact between the developers Dickins Hydro Resources and the SCA to try to understand the scope and scale of the proposals and any subsequent impacts upon paddle sports opportunities on these tributary rivers. The SCA also stressed to the developer the importance of these tributaries within the context of paddle sports and to the wider paddle sports community.

The developer at this stage welcomed the dialogue and showed willingness to work with us to further understand the concerns and requirements of the paddle sports community. We conducted a short survey within the paddle sports community at the end of last summer to try to understand and establish the various flow volumes on the tributary that are required to navigate the whitewater section. From the information gathered we were able to supply the developer with a number of dates and estimates river heights (low / medium / high) which were correlated with the flow monitoring information the developer had been gathering over the previous calendar year. This gave the developer an understanding of the requirements of the paddle sports community to build into the development of their proposals for water extraction.

Dialogue has continued with the developer in the intervening period with regard to the potential impacts and the development of a set of mitigation measures if the proposed scheme were to be granted, the details of which are considered in section 4.0.

3.3 Paddle Sports Impact

The last 10-15 years have seen a sharp rise in the number of run of the river hydro schemes being constructed as our society moves towards a more sustainable future using renewable energy resources. Whilst the majority of run of the river schemes have been installed on small watercourses with little impact upon paddle sports, but the number of schemes built upon rivers which do impact upon paddle sports opportunities remains significant. There can be few other sports or outdoor activities that have been as severely impacted as ours in the drive towards renewable resources. This disproportionate impact means that every new proposal further erodes our ability to enjoy the recreational opportunities provided by our natural environment.



Schemes like the one on the River Fechlin have seen an almost total loss of this resource, whilst developments like the one on the Arkaig have seen the construction of potentially fatal structures within the water course, despite consultation between the developers and the SCA in advance of construction works, to prevent such scenarios.

Indeed, there have been many scenarios in the past where the SCA has attempted to negotiate mitigation measures to try and reduce the impact of schemes upon the recreational users of these watercourses. Unfortunately we have rarely seen a successful package of mitigation measures translate into the operational reality of these schemes. Changes to the constructed scheme from that which was consented, as was the case with the River Pattack scheme, can often lead to a scenario where the mitigation measures agreed pre-development are no longer deliverable for a number of reasons. In cases where no specific mitigation measures were possible, but information to indicate that a substantial number of days when the whitewater section would still have sufficient flow to afford recreational opportunities would be available, such as the scheme on the River Lochy; translate to a scheme in reality where the number of days when the river has sufficient flow is so unpredictable, or infrequent, that the opportunities cannot be enjoyed mean the impacts are more severe than could be predicted. In all of these cases, there has been no recourse to assess or modify the ongoing impacts or to implement modification to the mitigation proposals.

3.3.1 'Paddle Days'

The Run of the river schemes do still provide some natural flows within the affected watercourse upon which paddle sports can be undertaken. However, these flows are moved towards the peak flows of the hydrograph where levels are much more unpredictable and significantly fewer over the course of the year. It is the reduction of the number of these 'paddle days' that is the best indicator of the potential impact any scheme has upon the recreational resource of the watercourse in question.

Analysis of the flow data reveals there to be approximately 180 days per year when the Allt a Chaorainn could potentially be paddled. The actual number of days is likely to be less given factors such as time of year, annual rainfall, daylight hours, day of the week etc. The same factors will affect to a varying degree the number of paddle days in any scenario, either pre or post development of a scheme. It is therefore taken that whilst this theoretical number will not translate into an actual number days, it is an acceptable comparator to analyse the existing and impacted opportunities.



Analysis of the number of 'paddle days' typically provided by Allt a Chaorainn in its natural state.



The developer provided the SCA with a short proposal of how they intend to mitigate the impacts upon paddle sports opportunities following the development of their scheme which is discussed in section 4.0. To understand the potential impact of the scheme, we first had to analyse this information to reveal the number of 'paddle days' the scheme would provide if there were no mitigation measures provided by the developer. Our analysis concluded that the proposed scheme, without any mitigation, which experience tells us is not an unlikely scenario, would see 'paddle days' reduce to approximately 60 days per year.

Included in Appendix B is a copy of the the Hydrometric Analysis carried out by one of our members who is a Civil Engineer, Hydrologist and Hydraulic Modeller whilst Appendix C contains a copy of the working proposal document submitted to the SCA by the developers Dickins Hydro Resources Ltd.

3.3.2 Access

Currently, access to the Allt a Chaorainn is taken from both the east and west sides of the river at its confluence with the River Etive. Traditionally the formal access point was on the West side so as to prevent any user conflict with the inhabitants of the cottage which sits on the banks of the Allt a Chaorainn. This route crosses a very soggy field with difficult underfoot conditions up to the point where a small footpath is reached and a footbridge over the Allt a Chaorainn provides access to the footpath which runs up the eastern bank. Latterly, since the property has become vacant, access has been more commonly taken across the moor outwith the curtilage of the property and up to the style over the deer fence just upstream of the afore mentioned footbridge. This route would now conflict with the location of the proposed turbine house, and plans to renovate and re-inhabit the house will see access likely forced back to the west side over the difficult ground conditions.



4.0 Mitigation Measures

4.1 On Demand System

Discussions with the developer have been ongoing over the last year to try and determine the potential impacts of the scheme proposals, and more importantly, a package of mitigation measures to try and minimise or completely remove any potential impacts the development may have upon recreational paddle sport opportunities on all of the Etive tributaries.

The developer has proposed the provision of an 'on demand' system where a manual button or digital pad is provided at a location adjacent to the access route to the whitewater section of the tributary. This button would activate a short period 'shut down' of the turbine which in effect returns the flow of the watercourse at that time down the whitewater section of the river, instead of through the hydro system. The shut down operation of the turbine is understood to be a standard operational procedure of the system and is similar to what the system would do once the current flow of the watercourse reduced to a flow insufficient to extract any water. This shut down period would restore the natural flow of the watercourse on the day for a fixed period of time sufficient to navigate the watercourse by paddle craft.

In theory, this mitigation proposal has the full support of the SCA and much of the paddle sports community with regard to the impacts upon paddle sports opportunities. The system would in effect remove any potential impacts upon recreational opportunities. The system would have the added benefit of reducing peak flows, when the river would normally be too high to safely navigate, even by expert paddlers, thus actually increasing the number of 'paddle days' on the tributary.

However, there are a number of factors of principal which need to be addressed and one which raises serious concern;

- 1. There is no element of any of the applications which detail this system, nor seeks consent for the implementation of such a system.
- 2. The details of this system are yet to be finalised and would require further monitoring, analysis in order to establish a working system.
- 3. The system would require a period of adjustment post-construction to ensure the required flows were being provided and that the period of shut down was adequate.
- 4. There are some environmental concerns regarding the proposal with regard to the potential fluctuation of water levels. Whilst the natural state of these tributaries sees the flows rapidly rise and fall, assurances are needed that the short period fluctuations implemented by this system are acceptable.
- 5. There are questions from some regarding the liability of a human interface which alters the flow of the watercourse
- 6. Does the system fully shut down to provide water down the whitewater section, or does it provide a standard set flow.

There are also the detailed aspects of the system which would need to be agreed prior to support for these proposals;

- 1. The base flow provided by the on demand system for periods Q30-Q60 (assuming 60 is the lowest point at which there is sufficient flow to navigate the whitewater section of the watercourse).
- 2. The pro-rata increase in any standard flow to replicate higher water days between say, Q15 Q 30 (when flows are sufficient).
- 3. The duration of any shut down period.
- 4. The point at which the natural flow down the whitewater section is sufficient without the on demand shut down flow.

The SCA would support the above system for mitigating potential impacts, but would require some form of legally binding assurance within either the Planning Consent or CAR Licence in order to safeguard the implementation and successful ongoing operation of the system. Without such, the SCA could not support these measures.



4.2 Other Flow Mitigation

Should it be considered that the 'on demand' system was unachievable or failed to meet the requirements of any standards and consent for the scheme was to be provided, we would still seek to establish a package of mitigation measures that reduced the potential impacts upon paddle sports opportunities. In this instance our preference would be for an agreed set of weekly 'shut down periods' to provide recreational paddlers the opportunity to catch the tributaries with sufficient flow. An outline structure for these periods may be as follows;

- A set weekly provision of shut down periods on Wednesdays, Saturdays & Sundays.
- 6 hour shut down period to allow the natural flow down the water course. 10am 4pm
- Provision of a 'set-flow' during certain Q flows to allow paddle sports opportunities and generation at the same time.

This equates to 18 hours shut down from a 168 hour week, or 10.71% of the potential generation time of the tributary schemes. This or a similar agreement should be considered the minimum requirements for a package of mitigation measures to paddle sports impacts that the SCA could accept.

4.3 Access

Discussions with the developer have also included the potential future access arrangements should the scheme be consented. Agreement in principal was reached that a new footpath (of appropriate upland design), would be constructed on the west side of the Allt a Chaorainn linking from the banks of the River Etive to the footbridge over the Allt a Chaorainn. We are surprised to find that this element does not form part of the proposals submitted for consent and would seek this element as a condition of any consent.

On all other tributary rivers, we would seek, as a minimum that the ability to access the water courses is not impeded by the developments and that alternative access arrangements are made where locked compounds surrounding the turbine houses impede access.

4.4 Safeguarding Agreed Mitigation Measures

Should a set of mitigation proposals be agreed either prior to consent, or in the negotiations following conditional consent, the SCA would need to understand the various mechanisms for compliance that the relevant authorities hold, and procedures for enforcing said measures, in order that we can provide our support to the development in its agreed form and safeguard the paddle sport opportunities provided by the tributary rivers in Glen Etive.



5.0 Conclusion

5.1 Summary Statement

The SCA would not want to see any development which negatively impacts upon the appearance of or experience of Glen Etive and understands there are a number of studies that have assessed these various impacts, and trusts in the judgement of the relevant professional persons and agencies that will assess and determine upon these impacts. The SCA have focussed therefore upon the various potential impacts of the proposals upon recreational paddle sports opportunities. The SCA cannot support the proposals without a guaranteed set of mitigation measures in place prior to consent, or with sufficient safeguards in place to proceed post-consent to reaching a detailed agreement of those mitigation measures.

Having worked with the developer over the last few months we are happy to support the outline principal of the mitigation measures as currently proposed. This support would be conditional upon the mitigation measures being built into the Planning Consent and/or the SEPA CAR Licence.

The impacts of the proposed developments are substantial if these mitigation measures are not implemented and would be devastating upon the recreational opportunities of our members and the wider paddling community as a whole. This includes the commercial operators, university groups and travelling paddlers who visit the area regularly and the various economic benefits they bring to the wider rural community.

We trust there will be continued dialogue between the relevant authorities, the developer and the SCA in order to address some of the concerns raised and the finer details of any mitigation measures moving forward.

On behalf of the Scottish Canoe Association

Gavin Millar SCA Access & Environment Policy Committee

19/07/2018



Appendix A:

Supporting Photographs





A paddler descending the first rapid on the Allt a Chaorainn, 'Speed'.





Above and Below; 'Ecstasy' viewed from afar, and down its length from a paddlers perspective.







The third rapid 'Pinball' with its wicked chicane kicking the paddler right then left.





The depths of the final rapid 'Chasm' viewed from above the pool.



Appendix B:

Hydrographic Assessment



Introduction

The Allt a' Chaorainn is a renowned and popular whitewater kayaking destination for both Scottish kayakers and those from further afield. Its gradient coupled with its smooth rock and crystal-clear water make it unique in providing spectacular cascades for relative novices and experts alike depending on the flow. Due to the moderate flows required to navigate it safely it is suitable for kayaking for approximately half of the days of the year. The range of flows suitable for kayaking range between 0.5m³/s and 4.0m³/s.

A review of the "Hydrometry Report" and the "Allt Chaorainn Eia Report Volume 1" submitted to the planning portal on the 4th of July 2018 has been carried out and an analysis of the impact the scheme would have on the number of days a year the river would be navigable. In addition, the increase in risk to paddlers as a result of the steepening of the hydrograph rising limb at low flows is discussed.

The report also discusses the option of a push button on the turbine house as discussed in the report "Proposal to The Scottish Canoeing Association concerning river flows on the Allt na Chaorainn and Allt Mheuran and other tributaries of the River Etive, Glen Etive: For the purpose of canoeing during hydro electricity generation" issued to the SCA.

Assumptions

Based on the EIA Report statement of:

"The main embedded design measures for operation are in accordance with SEPA guidance, which includes:

- Protection of low flows via a Hands off Flow (HoF) of Q90;
- Protection of flow variability in that the flow downstream increases in proportion to flow upstream rising to Q80 when flows upstream are Q30; and
- Protection of high flows. The maximum abstraction will not exceed 1.5 mean daily flow"

It is understood that no flow will be abstracted when the watercourse is flowing below $Q90 = 0.194 \text{ m}^3/\text{s}$.

It is understood that the compensation flow from the intake will increase proportionally to the flow in the watercourse such that when the flow in the watercourse is $Q30 = 2.142m^3$ /s the compensation flow will be Q80 = $0.311m^3$ /s. In the absence of precisely what proportion will be released as compensation it has therefore been assumed that for the purpose of this analysis the flow increases linearly between the "Hands off flow" and the Q80 compensation flow.

It is understood that the maximum abstraction rate at the intake will be no greater than 1.5 mean daily flow. In the absence of data on mean daily flow in the available literature it is max abstraction rate issued to the SCA is 2.644m³/s and all flows above the compensation flows will be abstracted until the abstraction capacity is exceeded.

<u>Analysis</u>

Table 1 and Figure 1 below show how the exceedance flows in the watercourse will be affected by the abstraction based on the above assumptions.



Table 1: Analysis of change in exceedance flows.

Exceedance (% of time)	Days a year exceeded	Allt Coire a Chaolain Flow (m ³ /s)	Allt a Chaorainn Flow (m³/s)	Allt a Ghiubhasan Flow (m³/s)	Total Existing Flow (m ³ /s)	Total Proposed Flow (m ³ /s)
5	18	3.846	3.737	2.695	10.278	7.634
10	37	2.476	2.242	1.758	6.476	3.832
20	73	1.377	1.135	0.995	3.507	0.863
24	88	n/a	n/a	n/a	2.955	0.311
30	110	0.858	0.655	0.629	2.142	0.311
40	146	0.572	0.409	0.424	1.405	0.292
50	183	0.392	0.264	0.294	0.950	0.272
60	219	0.275	0.175	0.209	0.659	0.253
70	256	0.193	0.116	0.148	0.457	0.233
80	292	0.133	0.075	0.103	0.311	0.214
90	329	0.084	0.044	0.066	0.194	0.194
95	347	0.060	0.030	0.048	0.138	0.138
99	361	0.033	0.015	0.026	0.074	0.074

*Grey shaded row has been interpolated between the two adjacent rows to give the point at which the abstraction capacity is exceeded.





Figure 1: Analysis of change in exceedance flows.

These flows and the number of days where the flow exceeds each given flow have been used to derive the number of days where the river is navigable. Linear interpolation between the data points has been used to bridge the variation between each data point.

In the existing case the number of days a year where the flow is between $0.5m^3/s$ and $4.0m^3/s$ is 180.8 days.

In the proposed case the number of days a year where the flow is between $0.5m^3$ /s and $4.0m^3$ /s is 61.3 days.

The number of days the river will in theory be navigable in the proposed case is approximately a third of the days it is navigable in the existing case.

Flows greater than 1.5m³/s are only suitable for a small number of expert kayakers and most of the paddlers who paddle the river are novice – intermediate. Therefore the number of days novice – intermediate paddlers can enjoy the river has been derived for comparison.

In the existing case the number of days a year where the flow is between $0.5m^3/s$ and $1.5m^3/s$ is 106.4 days.

In the proposed case the number of days a year where the flow is between $0.5m^3$ /s and $1.5m^3$ /s is 31.8 days.

This results in novice – intermediate paddlers being impacted to a greater extent by the development with only 30% of the days they could have previously paddled being available.

Increase in risk to kayakers

In all situations it is well understood that rapidly rising rivers are far more dangerous than slowly rising rivers as there is less time for people to react to a changing environment.

Though it is recognised that the hydro scheme will reduce the peak flows through abstraction there is an increase in the risk to kayakers during the rising limb of a hydrograph as the scheme will often push the "navigable region" into more rapidly rising sections of the hydrograph.



The following scenario is hypothetical but is based on the type of situation that commonly occurs on this type of river. The "Hydrometry Report" shows that the Allt a Chaorainn follows a similar pattern of hydrographs as the River Nevis therefore the flow/time data for the Nevis @ Claggan has been obtained from SEPA and a typical hydrograph extracted and flows scaled for the purpose of illustrating this scenario.

Scenario:

- 1. An intermediate group decides to get on the river as it is low and they are confident it is within their ability at this level.
- 2. 1 hour into running the river one of the more experienced members of the group decides to run one of the harder rapids and in doing so dislocates their shoulder and ends up swimming in a pool in a gorge.
- 3. Given the experience levels of the rest of the group they do not feel comfortable extracting their injured friend from the gorge and call mountain rescue for help. Given their proximity to Glencoe members of the rescue team are able to reach them and provide assistance within an hour.

As illustrated in Figure 2 in the existing case the group got on the river when it was low $(0.5m^3/s)$. As in the proposed condition it is not possible for them to get on the river as the compensation flow is too little for them to paddle they got on when the flow reaches a sufficient flow for them to paddle it.

In the existing case by the time the accident happened the flow had only increased to $0.65m^3/s$ (still low) as they are in a slowly rising portion of the hydrograph. In the proposed case the level at the time of the accident is $1.85m^3/s$ (medium) as they are in a more rapidly rising portion of the hydrograph.

By the time the mountain rescue arrive and are in a position to rescue the injured paddler, in the existing case the level is still low $(1.0m^3/s)$ where as in the proposed case the level has risen to $4.8m^3/s$ and is now far higher than the most experienced kayakers would consider navigating it and as a result the paddler (unable to exit the gorge in the state they are in) may be swept downstream with potentially fatal consequences.

There is therefore clearly an increase in risk to the kayakers as a result of the proposed scheme and this does not even take into account the potential for emergency shutdowns of the turbine causing a rapid increase of up to $2.644m^3$ /s within seconds or minutes which could cause a fun day out to become a serious accident.





Figure 2: Illustration of scenario in relation to realistic hydrograph

Discussion of "Push Button Mitigation Option"

The developer has proposed mitigation through the installation of a push button at the turbine house that would allow paddlers to effectively turn the river on for 4 hours. While it is appreciated that if implemented correctly this could mitigate the impacts to kayaking the river, the developer has not committed to this in any of the planning documentation submitted to the planning portal.

Additionally, there are numerous issues including liability (if the use of the button were to cause injury or death to kayakers or other parties) the operational technicalities and the CAR licensing process that the developer would need resolve to ensure the button were installed and maintained.

Given the impact turning of the turbine may have on revenue from the scheme it is likely that the developer will look for options to renege on their as yet not forthcoming commitment to install such mitigation justifying it on factors "out of their control".

There therefore needs to be a far more detailed plan of the mitigation proposed and a water tight commitment to install and maintain the mitigation before the paddling community should be prepared to remove objection to the scheme.



Conclusion

This report has discussed the impact of the proposed scheme on the number of days a year the river is navigable in addition to the increased risk to paddlers as a result of the proposed scheme.

The number of days the river is navigable is cut to approximately 1/3rd the number of days it is currently navigable with this impact being even greater for novice and intermediate kayakers.

Given the shift in the region of the hydrograph that the river will be navigable during there is an increased risk to paddlers with the potential for flows to increase rapidly from a low flow to an un-navigable and dangerous flow within hours, or in the case of an emergency shutdown of the turbines a matter of minutes.

It is therefore considered that the developer has not considered the impacts this scheme will have on white water kayaking on this river.

C.Peden Civil & Water Engineer

July 2018



Appendix C:

Proposal to the SCA concerning river flows... ...for the purposes of canoeing during hydro electricity generation.





Proposal to The Scottish Canoeing Association concerning river flows on the Allt na Chaorainn and Allt Mheuran and other tributaries of the

River Etive, Glen Etive

For the purpose of canoeing during hydro electricity generation

DRAFT



April 2018

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Introduction

Dickins Hydro Resources Ltd is planning to build 7 hydro schemes in Glen Etive on tributaries of the River Etive. We understand that river Etive is one of the most exciting kayaking rivers in Scotland and that certain key tributaries of the river Etive an exciting level of extreme canoeing at a level not found on many rivers in Scotland. We therefore understand the concerns of the members of the Scottish Canoe Association who are worried that a hydro scheme will significant disrupt their ability to canoe on the Etive and its tributaries.

Purpose

This document will aim to show that canoeing on the Etive will not be impacted in any way by the hydro schemes and that with the proposals we intend to make in regards to facilitating canoeing on the tributaries – specifically the main ones being the Allt na Chaorainn and the Allt Mheuran that the impact will be consigned to the time when the flows are their relative lowest. Indeed we believe that a hydro scheme could improve the canoeing experience when the tributaries are at the top end of their flow spectrum as the hydro scheme will abstract a specific volume of water thus reducing the flow in the tributary to a level that would be seen as safe by The Scottish Canoe Association and as a result will actually enhance the canoeing experience on the Allt na Chaorainn and Allt Mheuran.

Affected reaches & hydrology

Allt na Chaorainn



existing take out and put in locations

Proposed revised access subject to landowner approval

Proposed new take out location

Powerhouse location

Hydro intake locations

▲ Proposed on demand flow control switch location

Allt na Chaorainn – description taken from UK Rivers Guide Book

PUT-INS/ TAKE-OUTS: Park at the take out for the Middle Etive (NN 19714 51215), a layby just past the bridge. Cross the bridge and follow the markers leading up off the track to the stile over the deer fence. Do not go down the track to the house! Follow the path from the deer fence up the side of the river until you reach Speed (see photo below) (NN 19785 50588). Take out just after the footbridge near

the house on river left and walk down the field to the Etive. Cross the Etive and walk back up the road to your car.

TIME NEEDED: 1 hour including carry up, but you can lap the rapids to your heart's content.

ACCESS HASSLES: The house at the take out was very unfriendly to paddlers, however it was recently burned down, so access squabbles are now unknown. Try to keep well away from the house anyway, just to be cautious. The bridge over the Etive is sometimes locked - in this case you can just ferry across below it.

WATER LEVEL INDICATORS: Goes in the driest of dry weather, though is best with a little snowmelt or rain - more water makes the drops harder. You can inspect everything on the walk up and gauge how high it is.

GRADING: In low water this requires little skill, just good nerves. With more water the run comes up to a grade 4 to 4+ exciting run down. Even more water and the whole thing is one big grade 5.

Allt Mheuran



APPROX LENGTH: Several hundred metres.

TIME NEEDED: LOADS of time for Inspections and carrying! Two hours?

ACCESS HASSLES: No problems reported.

WATER LEVEL INDICATORS: High water would make this terminal. See below. You can see the falls from the road, though a good zoom lens or binoculars are required!

GRADING: Judge for yourself...

MAJOR HAZARDS/ FALLS: All of it.

GENERAL DESCRIPTION: Anyone who has paddled the <u>Allt a' Chaorainn</u> tributary should have a look at another small river entering river left near the get-out. This involves a lengthy walk but is worth every minute of it. It starts

with a straightforward <u>15 foot drop</u> followed by a couple of twisty drops and ends in a ridiculous 30 foot waterslide which terminates in a 15-20 foot fall (Warning - leaning back on take off can result in a hard flat landing). In low water this can be paddled with or without paddles and minimal protection. However, with any water at all this becomes very serious, as does <u>Allt a' Chaorainn</u>. There is a rock fall in the middle of the run making a rather worrying siphon when levels are high, take care. At low levels it will be easy to portage around.

OTHER NOTES: When we first went to paddle the Mheuran, it was late afternoon following a days rain having just paddled the <u>River Etive</u>, rising at about an inch every ten minutes or so. When we arrived at Allt Mheuran it was majorly humping and looked to be a certain suicide mission. However, we paddled the section from the last fall down to the <u>River Etive</u>, which was fairly full on itself with numerous tree and pinning options. Add to this, the fact that it is barely wide enough to turn a boat and watch as the carnage ensues.

We then left the boats hidden on the riverbank and came back at first light the next morning to paddle it at optimum? levels and hence I suffered my first swim in 2 years. However, with that out of the way, the <u>River Orchy</u> on 4 later that day seemed a doddle, and hence a couple more swims ensued, although fortunately not for myself...

Hydrology gauging results

Allt na Chaorainn 1400KW Adi to Surplus Allt na Chaorainn provide less max LT FDC 12 design canoe for canoeing Q mean m³/s levels comp canoeing 10 10.7922 2.6440 5 1.1500 9.6422 10 6.7998 2.6440 1.1500 0.8229 5.6498 8 2.6440 0.8229 20 3.6823 1.1500 2.5323 2.2493 2.6440 1.1500 0.8229 1.0993 30 6 40 1.4758 2.6440 1.1500 0.3258 0.9985 2.6440 0.546 0.8000 0.1985 50 4 0.6919 2.6440 0.5300 0.3121 60 0.1619 0.4797 0.3484 70 2.6440 0.5300 0.0000 2 0.3274 2.6440 0.5300 0.0000 80 0.385 90 0.2037 2.6440 0.5300 0.385 0.0000 0.1449 2.6440 0 95 0.5300 0.385 0.0000 80 10 20 30 40 50 60 70 90 95

Long term flow data produced by Hydro-Logic for DHR

Figure 1

Figure one shows the Flow Duration Curve for the Allt na Chaorainn at the hydro intakes. The horizontal line is the max design flow when the flow permits the hydro to operate at full power. This diminishes as the flow falls away.

The Scottish Canoe Association flow data

From the basic data provided by SCA members we have produced a mean flow of 1.15m³/s that we believe would more than facilitate canoeing on the river. Our calculation of 0.53m³/s is based on the indications a scrape levels, which seem to be the bare minimum required for canoeing. Therefore any flow levels above the basic scrape level, subject to nature providing enough water, should be acceptable to SCA members. The mean scrape flow would be facilitated down to Q60 but below that level there would be no compensation available.

At the high end of the SCA data we think flows are between 2.5 to $4m^3/s$ as compared against the 15 minute flow data collected by Hydro-Logic on our behalf. This shows that

from Q20 to Q1 the residual flows would permit the hydro to still operate at full power as well as providing more that enough flow to be classed as "high", being in the region of $3m^3/s$ and well above that level at Q5. Given that when both tributaries are running at full bore this might now make them worth considering at this level whereas in the past they were considered "terminal".

Proposal

The proposal from Dickins Hydro Resources Ltd (DHR) will be to provide an on demand control that will, when nature permits, provide suitable flow to facilitate canoeing on the Chaorainn and Mheuran tributaries. In essence there will be control point established at the east side of the bridge behind the Alltchaorunn cottage on the path up to intake, once activated it will trigger the computer to calculate whether there is sufficient flow available, as indicated by our "in river" level sensors at both the intake and at the canoe launch point. Assuming that there is sufficient flow to provide the level required to canoe the tributary then the computer will adjust the rate of abstraction at the turbine which will allow more water to flow over the intake and down the burn.

Operational parameters

We need to work with the SCA to determine what operational parameters need to be in regard to how long it will take to provide the right level of flow at the launch point and how long the modified flows will need to be active to facilitate passage down the tributary.

We kindly received the support of SCA members in providing indicative flow levels at the launch point which has helped us determine the ratios that will be necessary to successfully manage this process. We also intend to undertake some further flow gauging at the launch points to develop a more accurate picture for satisfactory launch flows.

Timing of flows

There will be some issues to resolve at a later date. For example:-

- How long does it take for the amended flow to arrive at the launch point
- How long does it need to be running to facilitate canoeing. Judging by the comments form the website above this could vary from 1 to 2 hours depending on which tributary and the number of canoeists present.
- Establish which months are preferred in order to determine if there is a pattern which might help to calculate the impact on DHR revenues.

Risk

We would like to understand more about liability. Whether or not insurance required or disclaimers – who is at risk and do canoeist carry insurance. The landowner could have concerns re liability, regarding access. DHR has concerns as to what the impact to canoeists

might be should there be a sudden change to water levels following a shut down. This could be a result of several things from electrical trip out to a mechanical shut down.

Access to launch sites

Access to the "put in" site at Allt Mheuran seems to be straight forward as indicated on the above plan. However, reconsidering the access route to the "put in" on the Allt na Chaorainn is worth looking at past issues and confrontation with residents of the house before it burnt down. The current Landowner will be rebuilding this house so now would be a good time to review access. We believe that "take out" could be just downstream of the confluence with the Etive and using a new a path to the bridge upstream and behind of the cottage. At the bridge there would be a control point for adjustment to the flow. This route, subject to consent from the Landowner, will not interfere with the dwellings at the site and hopefully avoid any future conflicts.

Summary

Whilst there is still some co-operative work to be done in order to fine tune a working solution, of which the first step will be to run a period of flow gauging at the "put in" point to provide us with more accurate flows at this point, than we have to date.

However, based on the flow data we have, we believe that it is feasible to provide sufficient water to enable canoeing on the Allt na Chaorainn from Q60 (Q60 being the % of the river flow during the year up to this level) if we assume that $0.53m^3/s$ is the minimum required with $1.15m^3/s$ being the mid level indicated by your data. At these levels canoeing will be possible and it will still be possible for us to operate the hydro, albeit at reduced levels, apart from when the flows are better than Q20 when the hydro will be able to run at high level as well. In fact, at flows of Q5+ the really big flows will be partially reduced by the max flow design for the turbine, which in turn will mean that the Chaorainn will still flow at the high to very high level which should also provide flows that are more useable at these upper levels.