



Hydraulics | Hydrology | Geomorphology | Design

## MEMORANDUM

<b>Date:</b>	Sept. 2010
<b>To:</b>	Kathy Dale, EnviroCentre Ltd
<b>From:</b>	Hamish Moir, cbec eco-engineering
<b>Project:</b>	Pumped Storage Scheme (Coire Glas)
<b>Subject:</b>	Interim report

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### PUMPED STORAGE SCHEME PROJECT Hydromorphology Interim Report

#### 1. General Introduction

Presented are preliminary results and interpretations of the impacts to hydromorphic processes as a result of the proposed development of the Coire Glas Pumped Storage Scheme on the north side of the Great Glen (Glen Albyn). The impacts to physical processes on the river downstream of the proposed impoundment and on the shoreline of the associated reservoir are assessed.

#### 2. Coire Glas

##### 2.1 Introduction

The Coire Glas scheme will involve the construction of a large dam (~90m high with a span of ~650m) on the Allt a Choire Ghlais/Kilfinnan Burn with a lowest elevation of ~470m (centre point of dam at OS NGR NN 237 956). As with all such impoundments, this will block all downstream transport of coarse sediment, the primary physical driver of morphological process and form (and, therefore, habitats) in alluvial river systems. This will affect a ~5.5km section of the stream. Of additional concern is the effect of reservoir drawdown on the morphological condition of the proposed reservoir shoreline, particularly as it will be situated on the steep corrie walls. The furthest upstream sections of the burn begin as very steep channels on the back wall of the corrie, merging at the small lochan, Loch a' Choire Ghlais. From the lochan outfall, the burn has a moderate-high gradient (Plate 1) until it enters a steep bedrock gorge section (characterised by a number of waterfall structures, Plate 2) and extends downstream until opening onto a large alluvial fan feature (Plate 3). The channel gradient drops sharply in the remaining ~0.5km across the alluvial fan before the entrance of the burn into Loch Lochy (OS NGR NN 281 956).

Presented are preliminary outline results of qualitative geomorphic mapping (i.e., channel morphology/ reach type) on ~6.5km of the Allt a Choire Ghlais/Kilfinnan Burn between the outflow from Loch a' Choire Ghlais and the outflow into Loch Lochy. The survey was carried out on 22<sup>nd</sup> July, 2010 and under moderate flow conditions (the receding limb of a high flow event on 21<sup>st</sup> July). The survey was initially attempted on the 21<sup>st</sup> July but heavy rain resulted in the river being in spate on that day. However, due to the 'flashy' character of burns in the region, water levels had dropped sufficiently by the following day to conduct the survey. However, the loss of a day's survey time meant that only the channel survey was possible in the allocated project time remaining<sup>1</sup> and the shoreline of the proposed reservoir could not be walked. Furthermore, the report concentrates on the likely effects of the proposed impoundment on channel morphology (through the mechanism of the predicted impact to sediment transport processes) rather than reduced flows in the depleted reach<sup>2</sup>.

## **2.2 Results and interpretation**

The results of channel morphology/reach type, sediment feature and river engineering analyses are shown in Plates 4 and 5. Generally, they indicate a highly energetic stream, particularly in the gorge sections, dominated by cascade and bedrock morphologies. Upstream of the gorge section the burn has a dominantly step-pool morphology, changing to dominantly plane bed close to Loch a' Choire Ghlais. These reach types are associated with very little in-channel storage of sediment in the form of bar features, evident from Plate 5. Plate 4 and 5 indicate a 'supply limited' geomorphic processes regime in this region of the river; the rate of sediment supplied to the channel is less than the ability of channel to transport that imposed supply (transport capacity). As the river exits the gorge section onto the large alluvial fan it changes through cascade, step-pool, plane bed and wandering morphologies, coincident with a progressive increase in the ratio between sediment supply and transport capacity. This is predominantly due to a decrease in transport capacity (related to a reducing channel slope) rather than a local increase in sediment supply. Although the reworking of alluvial sediments on an alluvial fan often provides a sediment source, the Kilfinnan burn is heavily confined through much of this section by large boulder embankments (Plate 6), inhibiting the recruitment of new material. Only the furthest downstream section of the alluvial fan remains unconfined (i.e., no boulder embankments) and the river here exhibits a dynamic 'wandering' morphology with multiple channels and within-channel storage of sediment (gravel and cobble-sized material) (Plates 4, 5 and 7). This morphological and sedimentary condition suggests an active sediment transport regime in this most downstream section of the river.

It therefore appears that the present day supply of sediment to the fan (potentially important in maintaining the integrity of the lower section of the alluvial fan and the morphology of the north end of Loch Lochy) is derived from upstream. However, the initial surveys did not reveal any obvious significant sediment sources (Plate 5). There are some candidate tributaries that are likely to be important but these are very steep and enter the Kilfinnan Burn in the gorge section. As such, the

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<sup>1</sup> Especially given the very rough terrain and lack of a consistent track/path all the way to the corrie wall.

<sup>2</sup> Since the relative reduction in flow due to the hydropower scheme will be very low during high flow events, the impacts to sediment transport processes (which are a predominantly a high flow phenomenon) will be negligible.

lack of evidence of sediment input in terms of transient storage features (gravel bars etc) could be due to the very high transport capacity of the system which may overwhelm potentially high rates of sediment supply. Transport of coarse sediment certainly does occur in the system with small accumulations of sediment in localised 'dead zones' (e.g., in the lee of boulders etc) evident, particularly in the section between the top of the gorge and Loch a' Choire Ghlais (Plate 8). However, the transport capacity of the channel is generally too high to permit larger accumulations of gravel/cobble sized sediment as significant bar features. In relation to assessing the likely impacts of the proposed scheme, it will be very important to determine the relative rates of the sediment supply - transport capacity ratio from upstream and downstream of the proposed dam location. If the majority of net sediment supply in the system is determined to originate from downstream of the proposed dam site then there will be a limited effect of the scheme on sediment transport processes and, therefore, channel morphology.

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Notes:



*Pumped Storage Scheme*  
**Typical channel morphology in the upper reaches of the  
Kilfinnan Burn, Coire Glas**

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**Plate 1**



Notes:



*Pumped Storage Scheme*  
**Gorge section on the Kilfinnan Burn, Coire Glas**

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**Plate 2**



Notes:

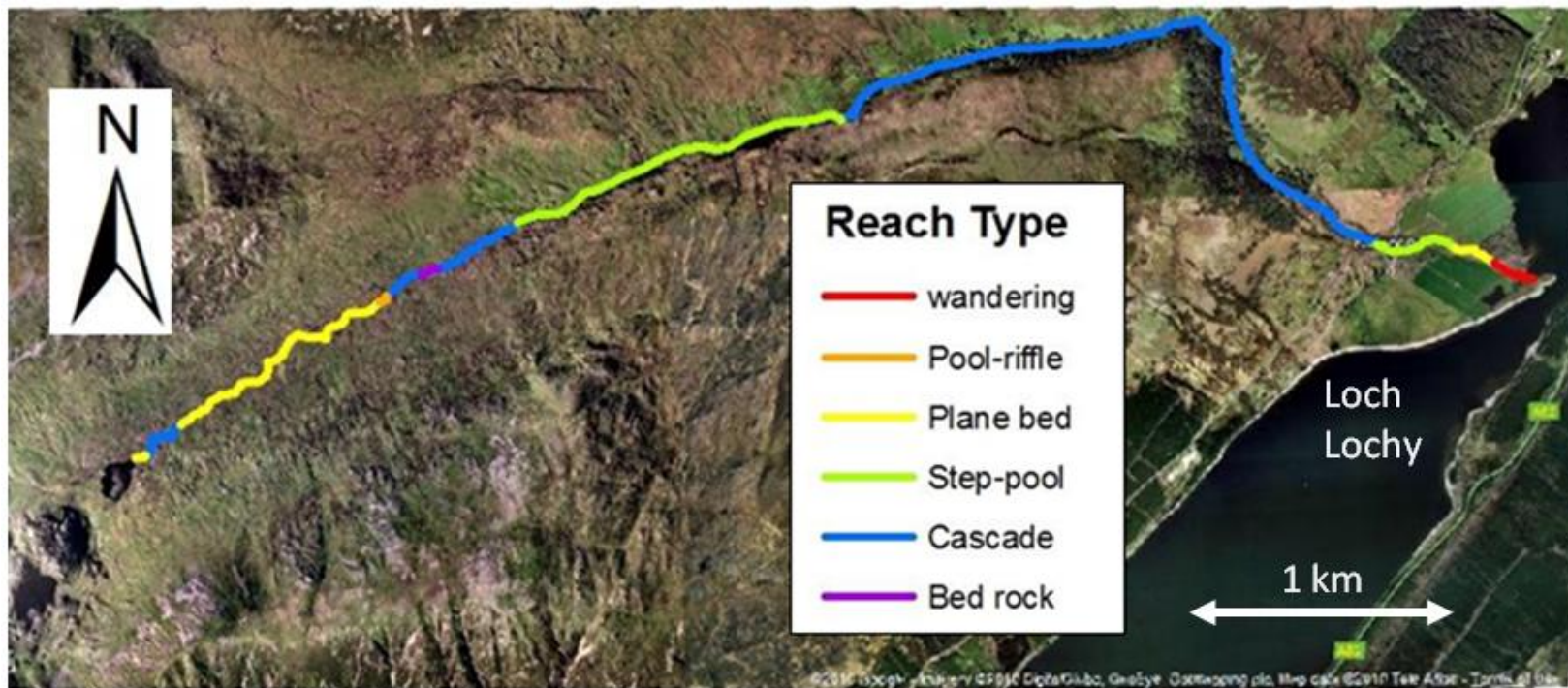


*Pumped Storage Scheme*  
**Large alluvial fan at Kilfillan entering Loch Lochy, Coire Glas**

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**Plate 3**



Notes:

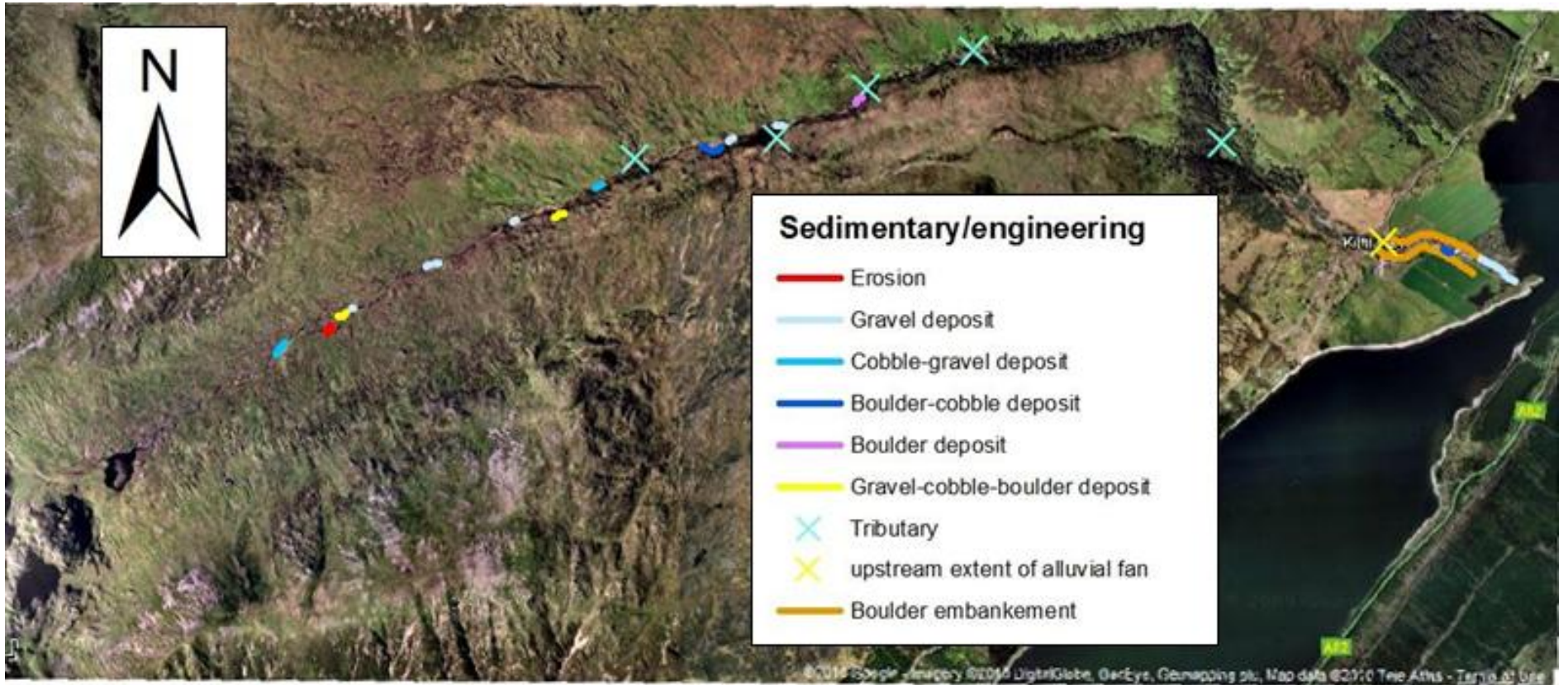


*Pumped Storage Scheme*  
**The distribution of channel morphology/ reach types on the  
 Kilfinnan Burn, Coire Glas**

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**Plate 4**



Notes:



*Pumped Storage Scheme*

**The distribution of sedimentary features and river engineering on the Kilfinnan Burn, Coire Glas**

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**Plate 5**





Notes:



*Pumped Storage Scheme*  
**Large boulder embankments on alluvial fan, Coire Glas**

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**Plate 6**



Notes:



*Pumped Storage Scheme*  
**Dynamic 'wandering' channel morphology at the  
downstream extent of the Kilfinnan alluvial fan, Coire Glas**

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**Plate 7**



Notes:



*Pumped Storage Scheme*  
**Example of localized gravel accumulation on the upper section of the Kilfinnan Burn, Coire Glas**

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**Plate 8**