

Beavers and the Crinan Canal Reservoirs

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SYNOPSIS

Beavers are known for their industrious construction activity. Following centuries of extinction in the UK, they have been re-introduced into the Knapdale Forests of Argyll for a five year trial. This may in time present new challenges to the Crinan Canal and its reservoirs. The management of the risks is discussed as is the applicability of the Reservoirs Act to beaver dams.

At the time of the reintroduction, the author was the Supervising Engineer for the Crinan Canal reservoirs.

INTRODUCTION

The Canal & River Trust, a charitable body, was set up in 2012 to look after the navigations in England and Wales, which were formerly the responsibility of the British Waterways Board. British Waterways had been established in the Transport Act of 1963 to manage the canal system, nationalised in 1947. North of the border, the waterways remain in the public sector, managed by Scottish Canals.

The Canal & River Trust is responsible for 72 statutory reservoirs. There are 21 canal reservoirs in Scotland.

The first beaver families were released in May 2009 into natural lochs in Knapdale Argyll as part of a trial reintroduction project.

BEAVERS

There have been no beavers in the wild in the British Isles since the 16th Century. They had been hunted to extinction for their fur and for the manufacture of perfume. The European beaver (*Castor fiber*) just survived in small relict populations in Norway (Telemark), Germany (Elbe), France (Rhône) and Eastern Europe (Pripyet). The North American or Canadian beaver (*Castor canadensis*) is a separate species.

Adult beavers weigh 20kg - 25kg and are around one metre in length. They live in families and survive for 10-12 years in the wild.

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Beavers are herbivores, eating bark, wood and plants. They can fell substantial trees quickly using their chisel-like incisors although they typically prefer smaller diameter trees (30mm to 200mm). They are crepuscular; mainly active at dawn and dusk. They do not hibernate.

The industry and construction skills of beavers in building dams and lodges are well known. The Institution of Civil Engineers depicts the beaver in its coat of arms for this very reason. Beavers may build dams in order to create deeper water in their territories so that the entrances to their lodges or burrows are submerged and to allow them to access good foraging areas. Dams are built across slow flowing watercourses usually less than 10 m across. In Western Europe these typically create impoundments of up to one hectare in size. Construction is carried out after dark. Food is stored for the winter underwater in these pools. Beavers live in both burrows excavated below the water line and in mound-like lodges constructed of piled-up sediment and timber.

REINTRODUCTION INTO KNAPDALE

The European beaver has been widely re-introduced on the continent, under managed conditions, since the 1960s. There has long been a desire amongst naturalists to reintroduce them into the UK. Ecological reasons are put forward, together with eco-tourism benefits and the righting of past wrongs afflicted upon the beaver population by humans.

Beavers had previously been released on a limited scale in fenced enclosures on an estate in the Cotswolds and a wildlife centre in Lancashire. There are also escapees in Tayside.

The Scottish Beaver Trial is a partnership between the Royal Zoological Society of Scotland and the Scottish Wildlife Trust, licensed by the Scottish Government, to release four families of beavers into a remote habitat of native forest and natural lochs in Knapdale Argyll.



Figure 1. Beaver family in Knapdale (Royal Zoological Society of Scotland)

Much of the land is owned by the Forestry Commission but beavers are not partial to non-native conifers. It is a five year trial being monitored by numerous independent bodies and coordinated by Scottish Natural Heritage.

Three families comprising eleven beavers originating from Norway were released into three separate lochs, Loch Coille-Bharr, Loch Linne and Loch na' Creag Mhòr, in May 2009 (Figure 2). The area is ideal for beavers with native woodlands, a natural watery environment and being remote from farmland. A few beavers have died; others have been introduced. There have been several young beavers ('kits') born.

A careful eye is kept on the beavers by the local team. At the time of release all beavers are fitted with radio tags, to facilitate monitoring.

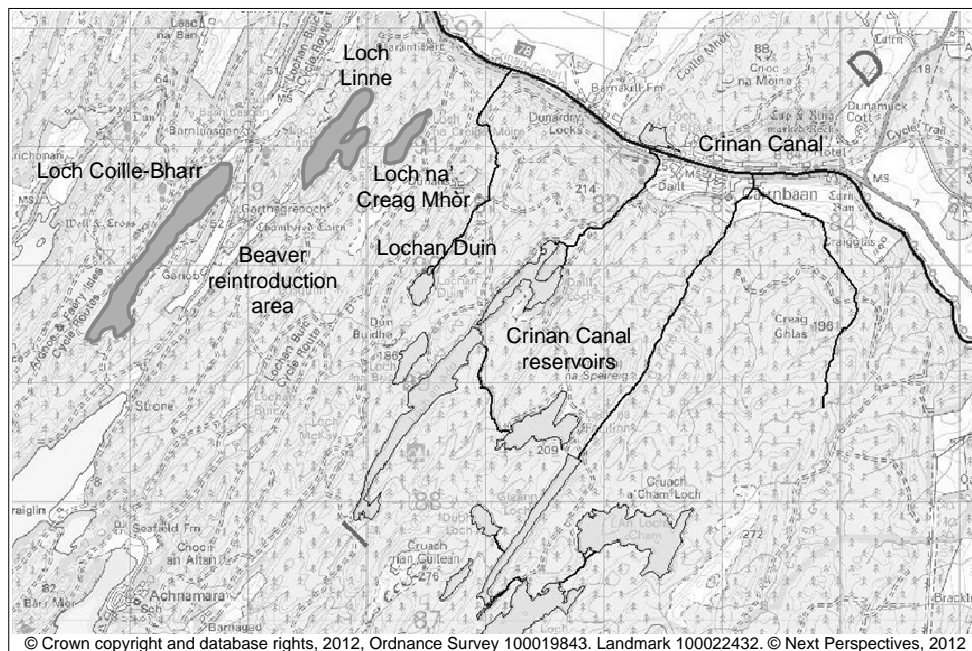


Figure 2. Location of the Crinan Canal, the Reservoirs and the Beaver Lochs

POTENTIAL THREATS TO RESERVOIR SAFETY PRESENTED BY BEAVERS

The Crinan Canal is less than 1km from the release site. It is supplied with water from nine reservoirs, the nearest of which, Lochan Duin is less than 1km from Loch na' Creag Mhòr. The canal and its reservoirs have been described in more detail in Brown D H (2009) Scottish Canal Reservoirs; a historical perspective Part 2 Crinan Canal.

Beavers can tunnel for up to 4m, approximately the width of the canal towing path and a good proportion of the thickness of a reservoir headbank at top water level, breaching any clay core or lining. The tunnel entrances

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are normally submerged and there were concerns that beaver activity could take place undetected, leading to unexpected and catastrophic consequences.

The possibility of beaver dams in the burns between the reservoir and the canal and within the reservoir catchments was not considered to present a great threat. Such dams would not form a major impediment to the flow of water and should they breach the amount of water released would be modest and present no significant threat to the canal or the reservoirs.

Meetings were held with Beaver Trial representatives, which went some way to allay these fears. They undertook to remove beaver dams from burns supplying the canal and confirmed that they would be carrying out surveillance to ensure that the beavers kept within the trial area. They did not consider that the beavers would spread from the release area for many years because there was ample suitable habitat there. Eventually they might seek out new territory alongside watercourses leading from the release area. The reservoirs are separated from the trial area by ridges of igneous rock.

This has mostly proved to be the case, however one beaver found its way shortly after release along the Crinan Canal to Kilmartin, over 5km away, from where it was recovered and returned to the trial area.

RISK ASSESSMENT

Risk assessment was carried out to identify the structures most vulnerable to beaver activity. Aspects considered were the distance from the release area, the suitability of the habitat, the vulnerability of the earthworks to tunnelling and the stability of the water level.

Beavers prefer static water levels on lochs surrounded by native deciduous woodland. The higher reservoirs, situated on barren moorland, and those surrounded by conifer plantations are not attractive to beavers. All the embankment dams are protected from wave erosion by pitching, extending over the full height of the dams. On some dams, the pitching has been replaced by rip-rap. It was considered that pitching was a sufficient deterrent to even a determined beaver. The threat of burrowing in the valley side adjacent to the headbank remained. Those dams with rock abutments were not vulnerable to such activity. The reservoir most at risk was Lochan Duin, being closest to the release site, with suitable habitats and with a static water level, not being used normally to supply the canal.

The canal itself is more vulnerable. The water level is fixed, it is mostly embanked on one side and pitching is placed only in the wash zone around water level. The summit reach of the canal is connected directly into Loch a' Bharain, a raised natural loch. The dam however is well protected with pitching.

RISK MANAGEMENT

Canal reservoirs are subject to weekly or sometimes twice weekly surveillance checks by trained and competent people. The canal itself receives a monthly length inspection.

The Beaver Trial arranged for one of the reservoir keepers to attend a week's beaver training in Bavaria. This gave him a better understanding of beavers and enabled him to identify signs of their presence.

There are normally no checks of reservoir perimeters. The risk assessment identified the need for this to give warning of beaver activity. Lochan Duin was to be checked monthly, five medium risk reservoirs quarterly and the remainder annually. This was to be done by the Trial team using a boat but has not proved necessary to date because the location of the beavers is known and there was no reason to suspect that there might be beavers at any of the reservoirs.

BEAVER DAM AT DUBH LOCH

During 2010, the beavers built a dam adjacent to Loch Coille-Bharr, raising the level of the water in the adjacent Dubh Loch, previously a marshy pool. The construction comprises a series of near vertical poles, with horizontal branches placed on the upstream face. This is then sealed with weeds and mud. There are no ancillary structures, outflows being catered for by the semi-porous nature of the construction.

The Dubh Loch dam is in two sections, either side of a rocky knoll, with a low dam across the knoll. The maximum height of the dam is about 1.5m and the total length about 20m. It is unlikely to retain sufficient water to be considered a 'large raised reservoir'.

It can be undesirable from an environmental point of view to raise the water level on certain sensitive water bodies. The licence states that beaver dams built on the outflows of those oligo-mesotrophic lochs (usually those in limestone areas) which are designated under Special Area of Conservation (SAC) status should be removed, or the water level otherwise controlled should environmental harm be caused. Permanent removal of beaver dams is challenging, however. They are normally rebuilt at night although if they are repeatedly removed, the beavers will normally accept defeat. In North America, devices known as 'beaver bafflers' or 'beaver deceivers' are employed to pass water under the dam, without the beavers becoming aware and taking remedial action. Jonathan Hinks (Hinks J L (2001) *The Beavers Strike Back*) has described the tribulations associated with an attempt in Alaska to use a Clemson beaver pond leveller.

It was not necessary to interfere with the Dubh Loch dam.

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THE RESERVOIRS ACT 1975 AND BEAVER DAMS

Section 1 (1) of the Act defines a 'reservoir' as a reservoir for water as such. Certain structures such as mine and quarry lagoons and canals are expressly excluded because they present different risks and are managed under separate legislation. A beaver dam seems no different from any other similar water body except that it has not been built by human hand.

Section 1 (2) confirms that the Act extends to any place where water is artificially retained to form or enlarge a lake or loch, whether or not use is or is intended to be made of the water.

Section 1 (1) (a) defines a 'raised reservoir' as one designed to hold, or capable of holding water above the natural level of any part of the land adjoining the reservoir. The Dubh Loch dam meets this definition. It may even be a 'large raised reservoir' designed to hold or capable of holding, more than 25,000m³ of water above that level.

The identity of the 'undertakers' needs some consideration. The Act had not considered dams made by non-human parties. The reservoir was built for the beavers' undertaking i.e. residency, transport etc., however not being 'persons' Section 1 (4) (b) (i) cannot apply, so the default under 1 (4) (b) (ii) must be that the owners or lessees are the undertakers.

Under the Reservoirs (Scotland) Act, when commenced, it is likely that the Dubh Loch 'reservoir' would be 'low risk'. There is a case for expressly excluding beaver dams from regulation because any medium or high risk structure could not be allowed to remain in place because of the threat to human life and property.

CONCLUSIONS

There is the potential for damage to reservoirs and canals from beavers and at first there were concerns that there would be adverse consequences from the reintroduction. However, through proper training and procedures the risks have been managed.

The Trial continues and in 2014, after five years, the Scottish Government must consider the evidence and decide if the reintroduction has been a success.

Beaver dams appear to come under the remit of the Reservoirs Act 1975 but consideration should be given to excluding them from the Reservoirs (Scotland) Act 2011, when it is commenced.

ACKNOWLEDGMENTS

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