

Dunside Reservoirs

the removal of two reservoirs from the Reservoir Act

by Louise Methven & Charlie Gallagher

Dunside Reservoir consisted of two reservoirs named Dunside Upper and Dunside Lower. They were opened in 1884 to supply drinking water to the surrounding area. They ceased operations in 2009 when Scottish Water deemed that it was not economically viable to continue to maintain the two impounding dams. The dams required weekly leakage monitoring and had to be inspected regularly by the Scottish Water Reservoir Engineer and Reservoir Panel Engineer (ARPE) to assess the dam conditions as part of the Reservoir Act 1975. The act states that any impoundment of 25,000m³ or more should be part of the Act. Scottish Water assessed the viability and future cost of the dams remaining within the Act and with agreement with the ARPE and SEPA deemed that they should be breached.



Full abandonment/enabling works

Scottish Environmental Protection Agency (SEPA), the ARPE and Scottish Water decided that the breach would be a full abandonment. As a result, the reservoirs were drawn down to empty and the fish rescued and relocated to a place of safety under licence by the Clyde River Trust team by Spring 2023.

Design requirements

Mott McDonald was appointed as designers with the outline design scope being:

“Dunside Upper and Lower Reservoirs are to be removed so that they are no longer capable of storing water, and therefore no longer subject to the Reservoirs (Scotland) Act 2011. This will be achieved by the removal of both embankments, distributing the excavated material across the former reservoirs and profiling to match the existing ground, and forming a channel through the former embankments to reinstate the natural watercourse.”

Scope of works

George Leslie Ltd was contracted by Scottish Water to carry out the reservoir abandonment works.

The works were undertaken between May 2023 and January 2024:

- Management of inflow to the reservoir, including temporary pumping to prevent refilling of the reservoirs during removal of each dam, and control of sediment to prevent discharges of water from the work site causing pollution of the receiving watercourses.
- Breach cut through the Dunside upper embankment (down to the original watercourse level). Work to be undertaken in a specified sequence.
- Breach cut through the Dunside lower embankment (down to the original watercourse level). Work to be undertaken in a specified sequence.
- Creation of a meandering channel through the base of each embankment, following the alignment of the original watercourse from historic drawings.
- Grouting of the outlet pipes through both embankments.
- Removal and disposal of valve towers/chambers, bridges, chambers, pipework.
- Infilling of the existing spillway channel.
- Hydroseeding of the breach cuts and material removed from the embankments.



(left) Dunside Reservoirs prior to breach, (middle) during construction July 2023, and (right) after breach - Courtesy of George Leslie Ltd

Construction challenges

Flood risk: The earthworks required were not particularly unusual in that only some 60,000m³ of cohesive materials had to be cut and carted to designated on-site depositories for placing and compaction. To control the levels of the earthworks, Trimble GPS controlled bulldozers and excavators were used.

The excavations were carried in pre-agreed stages to set levels above AOD as a requirement of a Mott MacDonald study 'Dunside Hydrology to Inform Construction Risk Review' to negate theoretical risks arising of a flood event whilst works were in progress. In addition, a maximum legally permissible impounded water level at each stage was set by the ARPE. This required a minimum of eight 200mm pumps to be located on site throughout the construction period in order that they could be deployed at short notice in flood events.

Silt mitigation: In the 140 years the dams were in place, the natural downstream movement of sediments on the submerged watercourses had stopped, resulting in a substantial volume of silts in the deeper areas of the reservoirs.

George Leslie Ltd had to ensure that every practicable measure was utilised to minimise silt discharges to the watercourses and avoid harm to the ecosystems.

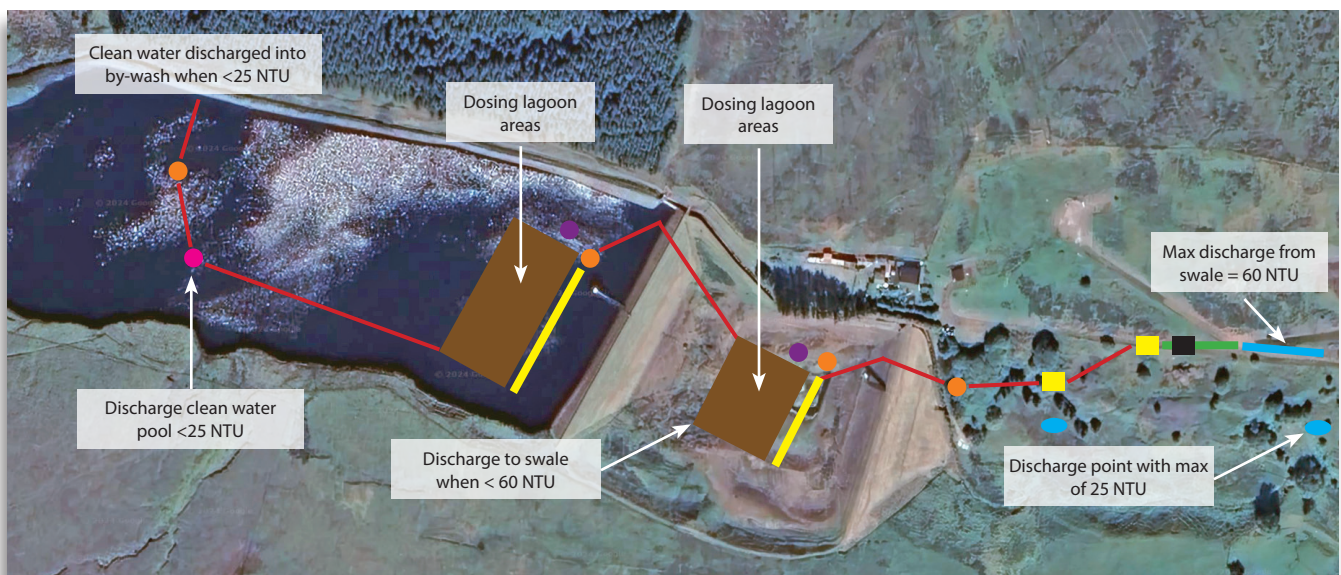
These measures were required during the reservoir drawdown and throughout the construction period as the excavated and fill surfaces remained exposed to the elements.

A Water Management Plan, detailing an extensive regime of settlement lagoons and swales, filtration through matting and bags, and finally lagoon flocculation using QP33 was developed and implemented prior to any release of water to existing watercourses.

QP33 is an organic coagulant, which is supplied and installed by Taytech Environmental Ltd. This coagulant is a primary chemical used in suspended solids settlement. At the time of writing (August 2024) QP33 was the only flocculant chemical approved by SEPA.

Sediment filter bags from Murlac Land & Marine Environmental Solutions are made of a 90 micron non-woven high strength (400 gsm) geotextile, which catch silt, sediment and oil, whilst releasing clean water. The Murlac sacs were connected to the de-silters to catch any finer silt before discharge.

During the construction phase, turbidity levels throughout the site and at designated points were monitored using turbidity meters and Secchi tubes. An Environmental Clerk of Works visited site at least once a week and compiled a report with recommendations and actions if required, which was made available to SEPA.



- Swale
- Bagging
- Clay bund
- QP33 dosing unit
- De-silters and/or settlement tank
- 8" or 4" pumps
- Murlac bagging
- Ditch lined with visqueen and sedimats along route
- Incoming water dammed to reduce water to Upper Reservoir
- Silt netting

Water management plan layout - Courtesy of George Leslie Ltd

The weather throughout July and August was generally cool and wet and as a consequence, all the earthmoving plant was required to stand down for long periods of time rather than generate turbid runoff. The water management, however, was required throughout the construction period and utilised a significant amount of resource and consequent cost.

Ecological constraints: Ecological constraints were present on site, such as nesting birds and otters. Exclusion zones were set up to protect ecological features, as part of George Leslie Ltd's commitment to minimise their environmental impact.

Hydroseeding: George Leslie Ltd was required to carry out hydroseeding as soon as was practicable, and as early in the growing season due to hilly nature of the site, on any finished surfaces in order to encourage early growth to minimise the area of exposed bare earth.

Dunside Reservoirs Abandonment: Supply chain - key participants

- **Designers:** Mott MacDonald
- **Main contractors:** George Leslie Ltd
- **Ecological surveys:** JK Ecology
- **Drone surveys:** Whitehouse Studios
- **Fish rescue:** Clyde River Foundation
- **Removal of tower:** PMP Utilities
- **Temporary bridges:** Groundforce
- **Pumping supply:** Selwood
- **Silt mitigation:** TayTech Ltd
- **Silt filter bags:** Murlac Land & Marine Environmental Solutions
- **Silt mitigation fences:** Hy-Tex UK Ltd
- **Hydroseeding:** Aitchison
- **Civils materials:** Keyline Civils
- **Tankering services:** Enviroclean

Reinstatements and formation of watercourses

Following the earthworks being completed, the formation of the watercourse was carried out. Hydro-morphologists from Mott MacDonald and SEPA had consulted historical maps, from prior to the original dam construction.

George Leslie Ltd was tasked with reforming the watercourse as closely as possible to the original course to replicate the sinuosity to appear more natural and less engineered. Prior to flows being gradually re-introduced over a prolonged period, coir fabric was installed temporarily on the burn banks to minimise scouring whilst vegetation growth took place.

The Clyde River Trust carried out invertebrate surveys of the stream beds prior to works and then subsequently one year after completion.

Carbon savings

One of the main targets within the contract was to utilise initiatives consistent with The Scottish Water Net-Zero Strategy. Initiatives George Leslie Ltd implemented included using batteries within the site accommodation and welfare buildings, and recycling and using arisings from the works by processing, crushing and grading to meet specifications. Scottish Water are planning to undertake tree planting throughout the area.

Conclusion

This contract is one in a series of similar future planned works and as such the lessons learned during the works are to be used in the planning and design of future dam breaching works.

The editor and publishers would like to thank Louise Methven, Sub-Agent, and Charlie Gallagher, Senior Site Agent, both with George Leslie Ltd, for providing the above article for publication.



Reinstatement of the watercourse - Courtesy of George Leslie Ltd



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