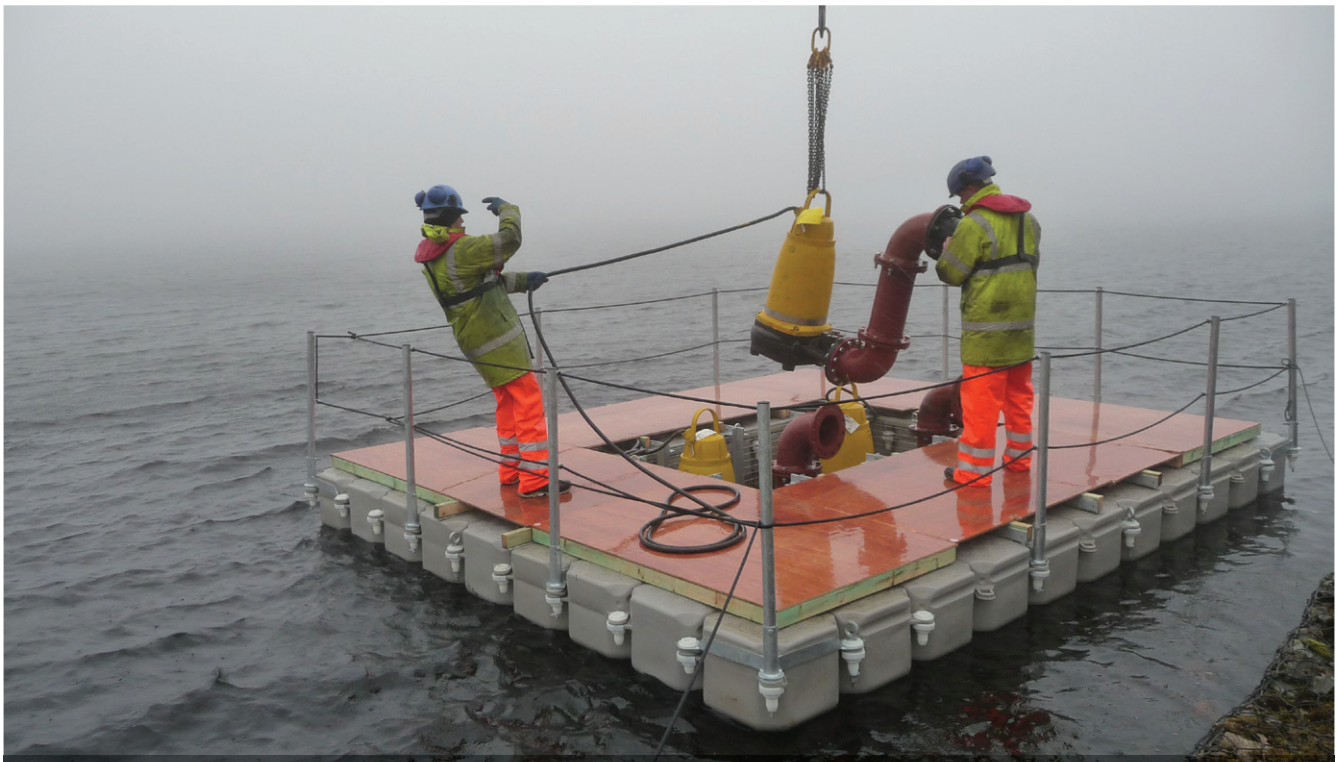
# Birkenburn Reservoir

## innovative method of lowering a reservoir's water level to allow for remedial works, without introducing suspended solids into the water discharge

Birkenburn Reservoir lies high in the Kilsyth Hills in North Lanarkshire, near Glasgow. The reservoir has a water capacity of 780,592m$^3$ and supplies water to the Forth and Clyde Canal. Like most reservoirs, Birkenburn requires almost constant upkeep and maintenance, but its location, two and a half miles up a dirt track, makes even routine maintenance a difficult undertaking. When major remedial works were identified for Birkenburn Reservoir, the issue was how to dewater a reservoir on top of a Scottish mountain without causing silt pollution downstream.



*Pumps being assembled into the floatation raft before being eased out to the centre of the reservoir - Courtesy of Xylem*

### Reservoir inspection

Following an inspection by the All Reservoirs Panel Engineer (ARPE) in 2006, a number of remedial works were identified for the reservoir, including the refurbishment of the existing discharge pipe and an upgrade to existing leakage monitoring, along with improvements to dam and spillway wave protection.

May Gurney, the infrastructure support services company, were contracted to complete the work on behalf of British Waterways, but it was clear that in order to complete the works, the reservoir level would have to be reduced by 8.5 metres from a spillway weir crest and have that level maintained for the duration of the works, a three and a half month period. In addition, the flow rate had to be monitored and was not to exceed 600l/s.

It was of paramount importance that silt or suspended solids were not introduced into the discharge. However, in a previous attempt at water removal utilising the existing discharge pipe, suspended solids pollution of the waterways occured downstream of the reservoir.

### Dewatering solution

May Gurney contracted Xylem Water Solutions to devise a plan to remove water from the reservoir without introducing suspended solids into the water discharge. Their solution was to install a floating pontoon at the deepest point in the reservoir which would contain 3 (No.) off-electric submersible pumps powered by a temporary generator on the bank. The plan required the pumps to be located in a basket which would ensure that the suction side remained at a constant depth of 500mm below water level. This would then allow only clean water being pumped and a minimum disturbance of any silt layer.

### Remote site has logistical issues

The plan for dewatering a remote reservoir without silting was only part of the problem. The key logistical issue was how to get the equipment to the reservoir up a dirt track in appalling weather conditions, despite the fact it was July. The solution was to have a base camp and assembly point to break up the journey and create an area where the equipment could be put together before installation.

### The dewatering operation

The plan was for the discharge hoses from the pumps to be directed into the spillway and, as the water level fell, the pontoon would drop to the required level. The pumps would operate at a capacity of 575l/s, enough to overcome incoming flow and reduce the water level while keeping within the maximum output permissible.

*The key logistical issue was how to get the equipment to the reservoir up a dirt track in terrible weather conditions - Courtesy of Xylem*


*The three rental pumps are in the middle of the reservoir housed in their floatation raft - Courtesy of Xylem*

With this pumping solution, the maximum discharge was only required at the start of pumping operations while the level was being dropped. Once the minimum level was achieved, only maximum incoming flow needed to be pumped. Because the pumps were located 500mm below water level at all times, the silt levels could be monitored below the pumps, which could be stopped in the event that any silt was disturbed.

Once the pontoon and pumps were in position, separate retrievable mooring blocks were lowered to the reservoir bed on lifting chains and a 2.5m length of steel cable was fitted to the mooring block with control devices attached. This ensured that once the pumps reached a level of 2.5m from the silt, telemetry signals would be sent to ensure that the pumps would stop automatically to allow manual monitoring and control to commence, and ensure no disturbance of the silt layer.

### Water quality testing

One of the key issues with the plan was water quality testing. Prior to the activation of the pumps, the water quality was tested within the reservoir and spillway channel. Monitoring stations were placed in the reservoir and granite spillway channel, in the form of hand held units to measure turbidity and silt levels. In addition, a telemetry unit was fitted to the equipment to monitor the status of the pumps to ensure that an automatic dialup service was activated to a series of predetermined telephone numbers 24-hours a day in the event of pump malfunction.

### Conclusion

Xylem sucessfully lowered the reservoir level by 8.5m, allowing May Gurney to complete the refurbishment works on schedule.

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