CONCRETE CANVAS®

REMEDIATION

Project Info

- 01 / 10 / 13
- CC5™ Bulk Rolls
- 7,500m²
- Transverse layers
- Bowburn Flume, Dumfries & Galloway, Scotland
- Cubby Construction on behalf of Scottish Power
- CC5™ used to remediated a dilapidated concrete flume forming part of a hydro-electric system

CUBBY CONSTRUCTION

Section of completed flume

In October 2013, Concrete Canvas® GCCM* (CC) was used to remediate a 1.5km concrete flume, forming part of a hydro-electric scheme operated by Scottish Power, in Dumfries and Galloway, Scotland.

The flume was originally constructed in circa 1935, using concrete cast in-situ. It channels water between two intake sluices and during high run-off periods, flow is diverted via the flume into a nearby loch for storage. The flume was a trapezoidal channel of 5" deep concrete, with a base width of approximately 1.07m, approximately 1.0m deep with sloping 45° sides. The overall profile varied but was typically 3.0 - 4.5m wide. The flume above the concrete was formed in earth embankments to suit the contours of the surrounding land.

Various inspections and repairs of the flume had been undertaken over the last 10 years. The inspections had revealed several areas which were in need of refurbishment. The surveys highlighted that the whole length of the flume had algae, moss and grass growth, covering a varying amount of the top surface. There was a substantial build up of gravel and detritus at certain locations and the condition of the concrete panels was variable. Rather than using conventional concreting techniques, CC was proposed to significantly mitigate the need for costly periodic repairs. Traditional options previously used had included sprayed concrete and removal and replacement of sections of existing concrete.

Installation was carried out by Cubby Construction for Scottish Power, with design consultancy provided by A. L. Daines and Partners.

*Geosynthetic Cementitious Composite Mat

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Remote site location

Dumfries & Galloway Hydro-electric Scheme

1.5km dilapidated concrete slabbed flume prior to installation

Algae, moss and vegetation growth within flume invert

Prior to the installation of Concrete Canvas, the flume was pressure washed to remove vegetation and minor repairs were carried out using a semi-dry grout mix to fill any voids in the concrete larger than 50mm. Bulk rolls of CC5™ were delivered to site and cut to specific profile lengths eliminating any wastage. Each length of CC was laid transversely and fixed in place using 34mm Hilti nails with 25mm diameter washers shot fired at centres not exceeding 600mm. Adjacent layers of CC were overlapped by 100mm in the direction of water flow. End sections of CC were cut with an angle grinder post-set to provide a neat finish.

The CC was able to accommodate sharp bends, junctions and terminals, interior and exterior pipe protrusions and a series of cascaded steps. In future projects, flume sections likely to experience very high turbulence and eddy forces (also known as Foucault currents) would be lined with CC13™ with additional fixings for further reinforcement. It was originally considered to seal the overlapped layers of CC using a beaded polyeurthane sealant or thermally bonding the joints. However, it was determined that it would be beneficial for the joints to be free draining. The free draining joints would create natural weep paths to allow water ingress into the flume, preventing build up of hydrostatic pressure between the original concrete slabs and the CC.

CC has a very low wash out rate and low alkaline reserve meaning treating runoff before discharging it into the water course was not required as there was no risk of harm to the local ecology.

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Remediated flume lined with transverse layers of CC5

Anchor trenching of far crest

Inlet channels lined with CC to direct bank runoff into flume

CC lined cascade section

Intermediate intake pipe lined with CC and finished flush with grout

CC5 fixed using 34mm Hilti nails with 25mm diameter

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Remediated flume lined with CC5 transverse layers

CC installed at rates of up to 600m² per day

CC able to accomodate sharp bends

CC layers overlapped in direction of water flow providing natural weep paths

A total of 7500m² of CC5™ were installed over a 6 week period at rates of up to 600m² per day in inclement weather and in a remote location. The performance of the CC will be reviewed by half yearly inspections of the flume in relation to abrasive nature of the water on the CC. The use of CC allowed Scottish Power to line the entire length (1500m) of the flume encasing all the concrete defects, thus negating the requirement to carry out concrete repairs every 2 years, saving the client time and money.

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Bowburn Flume 4 years on

Four years after installation, a return visit to the site found that CC is performing as expected and has begun to blend in with the environment. Moss and algae have begun to grow on the surface of the material, creating a 'greening' effect. Concrete Canvas® is now certified by the BBA with a durability of 120 years and as such is expected to considerably extend the working life of the flume.

"It was our first experience of installing Concrete Canvas but we were impressed with the ease and speed of installation, particularly given the challenging conditions on a remote site. In particular, the ability to install in wet weather greatly reduced down time that we would have normally experienced with traditional methods."

Mike Rippon
Commercial Manager,
Cubby Construction Ltd.

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