Constructing with gabions is a highly sustainable civil engineering application that ensures structures blend in with the environment, and it all starts with a professional design approach that maximises labour and minimises costs.

By Alastair Currie

When it comes to gabion structures, ensuring their integrity depends on a combination of correct material specification, design and construction technique. Older gabion structures need to be revisited some years down the track where galvanised wire was used in their original construction, especially for river protection and hydraulic structures.

“For any potentially corrosive environment, we always recommend Galfan-coated, soft-temper steel wire for gabion construction,” explains Louis Cheyne, managing director of Gabion Baskets – a company that manufactures and supplies gabions and supporting geotextiles, along with design, training and installation services.

“A further PVC coating is then applied during the manufacturing process to provide added protection when these products are installed in polluted environments where soils or water are acidic. This PVC coating usually has a nominal thickness of 0.50 mm, and helps to significantly preserve gabion structures for many decades. However, the same cannot be said for standard galvanised wire, which will inevitably fail.”

Cheyne points out that climate change impacts need to be factored into future designs and remedial works. The increase in extreme floods and droughts, for example, has led to the rapid deterioration of gabion structures in river systems where incorrect techniques and products have been specified. Retaining wall installations also need attention for the same reason.

Project scope:
Embankment stabilisation
Gabions: 115 m²
Wall footprint: 45 m²
Costing: R1 500 m⁻² to R2 000 per m⁻³
Location: Parkhurst, Johannesburg
Gabion production rate: Approximately 1.5 m⁻³ per man per day
Duration: Two and half weeks with some 15 personnel
Challenges: Stone materials needed to be transferred over a distance of about 150 m

Details
A gabion skin revetment wall constructed for a private residential development in Parkhurst, Johannesburg. The wall is approximately 4.5 m high and has a 500 mm foundation.

Unlike mass gravity walls, where the base width might be 55% to 60% of the height, a skin revetment is a thin gabion wall cladding on the external facing of the embankment to stop soil erosion. A 200 g/m² geofabric was installed behind the gabion wall to promote drainage. The wall is stepped back at 500 mm intervals all the way to the top.
Wing walls outflanked

“Within river systems, designers need to take into account worst-case scenarios when they design hydraulic structures,” points out Cheyne. “For example, we frequently see examples of concrete wing wall designs on gabion weir systems that are inadequate as a protection measure, typically being too short. When river levels rise, these wing walls become outflanked.”

This underscores the need for detailed surveys by hydrologists and geotechnical specialists to ensure that an accurate assessment is determined, which includes the founding requirements. From an insurance perspective, damage claims will always start with an investigation on whether the structure was installed correctly.

“A proper foundation is vital and, here, gabion mattresses provide an effective solution in minimising the effects of up- and downstream flows, reducing water velocity and, subsequently, soil erosion,” he continues.

Culvert interventions

Roadworks and stormwater protection systems form a large staple of the work carried out by gabion contactors. Culverts, in particular, are at risk when it comes to erosion around these rigid, monolithic structures.

“Ideally, designers should factor in gabion interventions at the initial construction phase to counter up- and downstream erosion,” says Cheyne. “In the longer term, culverts do tend to experience erosion threats, but these can simply be countered with the installation of gabion mattresses, which are highly effective.”

Typical erosion here entails downstream scouring, with deep holes forming and foundational soil loss. Installing gabion mattresses reduces water velocities significantly. These mattresses are tied into the concrete culvert structure with dowels. Thereafter, concrete is poured on to the top of the first 500 mm to 1 m section of the mattress to ensure a secure connection.

Fish farming

Gabion design applications are limited purely by the imagination. In recent times, for example, Gabion Baskets has supplied solutions for South African fish farming ventures in regions that include Gauteng and KwaZulu-Natal.

“Aquaculture is seen globally as a major growth industry and a meaningful solution in Africa to address protein deficiencies and food security in general,” says Cheyne.

Past Gabion Basket installation examples entail the use of gabion walls in ponds to create natural separations for breeding fish populations. By continuously pumping through the gabion walls, this serves to naturally purify the water.

Retaining wall innovations

Whether for building or civils work, retaining wall structures remain a core component of Gabion Baskets’ business, for both public and private sector clients.