05 Retention walls

Environmental impact	2/3
Risk protection	3/3
Durability	2/3
Affordability	2/3

Intro

While bank protection (riprap) reduces erosion along the embankments, sometimes retention walls are necessary to avoid landslides from the terrain above the water body. These can be built from different materials, including wooden or metallic planks, as well as gabion walls. Gabion walls describe galvanized mesh-boxes filled with rocks that are stacked in the form of closed cages. The purpose of the permeable gabion walls is to stabilize soils. Besides embankment stabilization, the also contribute to protect from flooding and to reduce the waterflow.

Benefits and Risk

The benefits of gabion walls include the use of local excavation materials which decreases the transportation costs and emissions. In addition, the intervention becomes more efficient in time due to vegetation that grows between the rocks and strengthens the structure. Due to their permeability, gabion retention walls hinder the water to build up behind the floodwalls and protects from waterlogging. Finally, the effect duration of gabion walls is comparatively long due to the stone blocks' durability.

Good practice

Gabion retention walls in the Swat Valley, Pakistan
In 2022, devastating floods took place in Pakistan. Among the affected areas was the remote Swat Valley in Khyber Pakhtounkhwa in the north-west mountainous region bordering Afghanistan. The strong rains caused rivers to quickly overflow, creating destructive flash floods along the main Swat Valley and its side valleys. In addition, numerous landslides caused massive destruction in the region. Many houses and public buildings were washed away, roads cut and bridges destroyed, leaving the villages without access to any external support.

The rapid emergency repair works included the reinforcement of infrastructures like roads and the installation of protection walls around buildings. For the latter, mainly gabion walls were used, since the adequate material is widely available in the region and the method is low-cost and quick to implement. The stones carried by the overflowing rivers could directly be crushed and used for gabion reinforcement walls, limiting the needs for transport to wire mesh only. This was especially well adapted for remote areas without car or truck access.

Right after the floods, the Swiss Humanitarian Aid sent a team to support emergency repairs to infrastructures and public buildings. Gabion was used for the emergency repairs of schools and to build reinforcement walls around the school grounds, avoiding landslides and thus increasing the safety for the children. Four weeks after the disaster, the access to the first schools was possible, and at the end of the project after 3 months, 11 schools were rehabilitated through the action, allowing more than 1'400 children to go back to school.

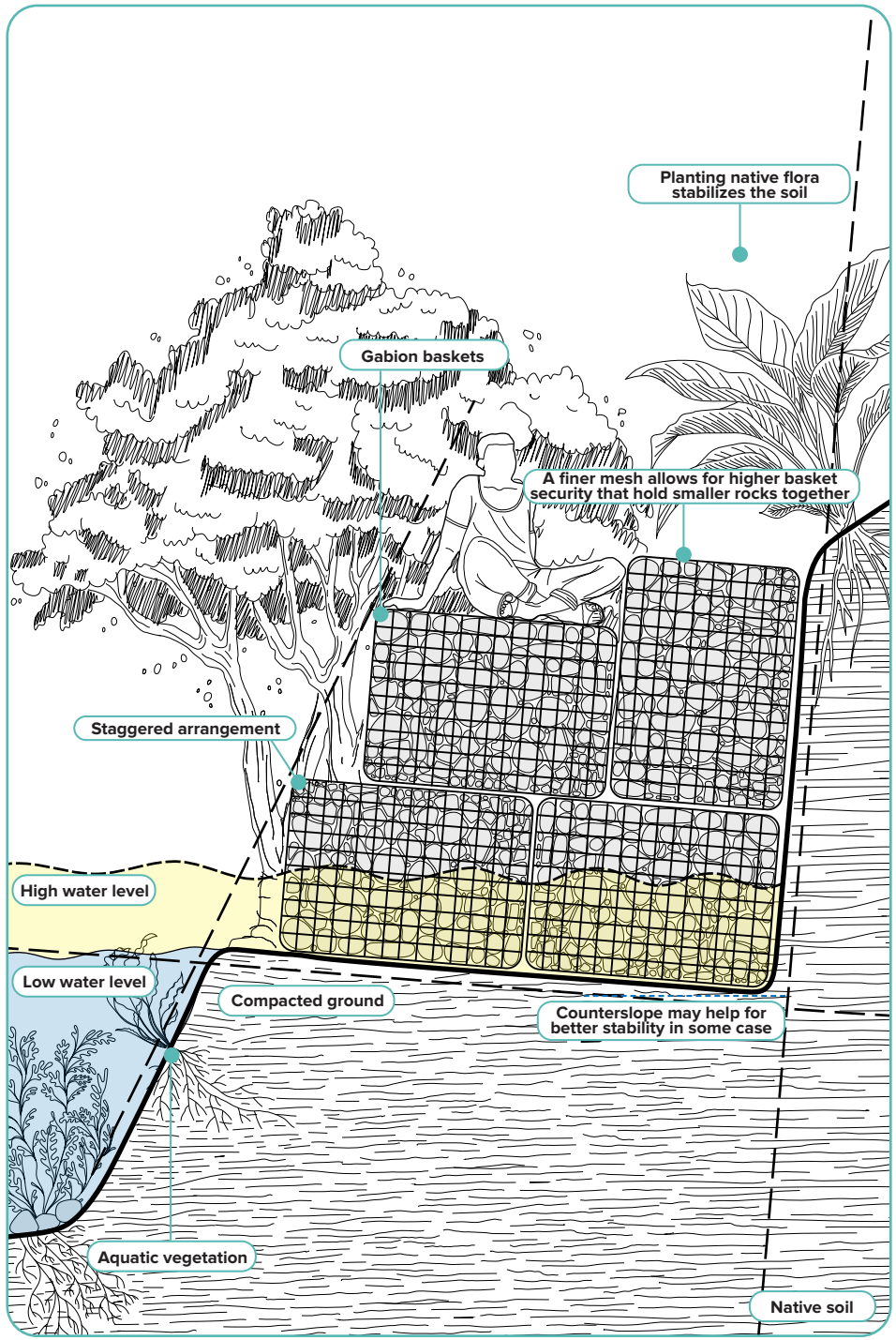

Fig. 07*: Torwal school in the Swat Valley, Pakistan. Rehabilitation works with gabion walls. Christian Neuhaus, SDC 2022.*

Overview of Criteria

Type of Intervention:
Engineered, Hybrid.

Scale of Intervention:
Settlement, Supra-settlement

Materials:
Galvanized meshes, stone rocks.

Environmental Impact:
Gabion retention walls show low transportation emissions due to local material use (if locally available).

Targeted Natural Hazard:
Coastal/Riverine Flood

Targeted Vulnerable Assets:
Buildings, Land Cover.

Strategy Type:
Reduce Hazard Magnitude.

Implementation Time:
Short (1 day - 1 month).

Effect Duration:
Long-term (>10 years).

Investment Costs:
Low

Maintenance Costs (yearly):
Low (<10% investment costs).

IOM Yemen (2022)
Gabion Walls Protect Displaced People's Life from Floods in Taiz. Available online at:
https://www.youtube.com/watch?v=x5psinEYZWg

Fine Mesh Metals (2021)
Gabion Standard Design. Available online at
https://www.gabionbaskets.co.uk/gabion/gabion-wall-standard-design.

Geotech (2023)
Gabion walls – function, application, advantage. Available online at
https://www.geotech.hr/en/gabion-walls/.

Flood Risk in Humanitarian Settlements: Compendium of Mitigation Measures

Spatial Development and Urban Policy, SPUR
ETH Zurich - Institute for Spatial and Landscape Development
Bruna Rohling, David Kostenwein, Mona Gairing, David Kaufmann

Geneva Technical Hub, co-convened by UNHCR and SDC
Ammar Al-Mahdawi, Emilie Schmid, Eric Bardou

External Experts
Mrudhula Koshy, Diego Bermúdez, Jonathan Parkinson

Layout and Drawings
Santiago Beaumé, Paola Pabón

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