

08 | Bioswales and Infiltration basins

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Risk protection	
Rain gardens, bioswales	1/3
Infiltration basins	2/3
Durability	2/3
Affordability	3/3

Intro

Bioswales: (also: *Vegetated Swales*) describe low-lying, vegetated, or mulched channels with gentle slopes. As a nature-based alternative to engineered gutters or sewers, they can treat, reduce, decelerate, and absorb stormwater runoff. The intervention is particularly efficient in the event of less heavy but frequent precipitation. In larger stormwater events, bioswales still play a significant role in the overall runoff reduction and the removal of pollutants. However, a bioswale acts more like a corridor for the rainwater, leading it to another point (e.g., into a rain garden or infiltration basins). That is why bioswales are often used in combination with rain gardens and infiltration basins.

Rain gardens and infiltration basins: Rain gardens and infiltration basins mitigate the runoff during (heavy) rainfall by infiltrating the water flow. While both interventions have the same function and are characterized by highly permeable soils, rain gardens are smaller than infiltration basins. Rain gardens are mostly implemented at plot and community/block scale, the water being collected from the roofs close by or the water channeled through a bioswale. The infiltration basins tend to be of greater extent and mitigate direct stormwater runoff. As a result, rain gardens and infiltration basins serve as simple and sustainable measures to prevent the nearby shelter, public spaces, and pathways from being flooded. At the same time, they support groundwater recharge.

Benefits and Risk

Bioswales Besides channeling and infiltrating stormwater, bioswales offer various co-benefits. One such benefit includes the provision of new habitats for local flora and fauna. In addition, bioswales support the plants' uptake of nutrients and the removal of pollutants.

Rain gardens and infiltration basins: Next to supporting stormwater infiltration, rain gardens are easy to maintain and retrofit. They are nature-based, small-scale, and affordable. At the same time, rain gardens and infiltration basins can be a source of livelihood. They might generally improve the appearance of open spaces and remove the rainwater from pollutants before it enters the groundwater. However, rain gardens are mainly suitable for low flow capacities of rainwater.

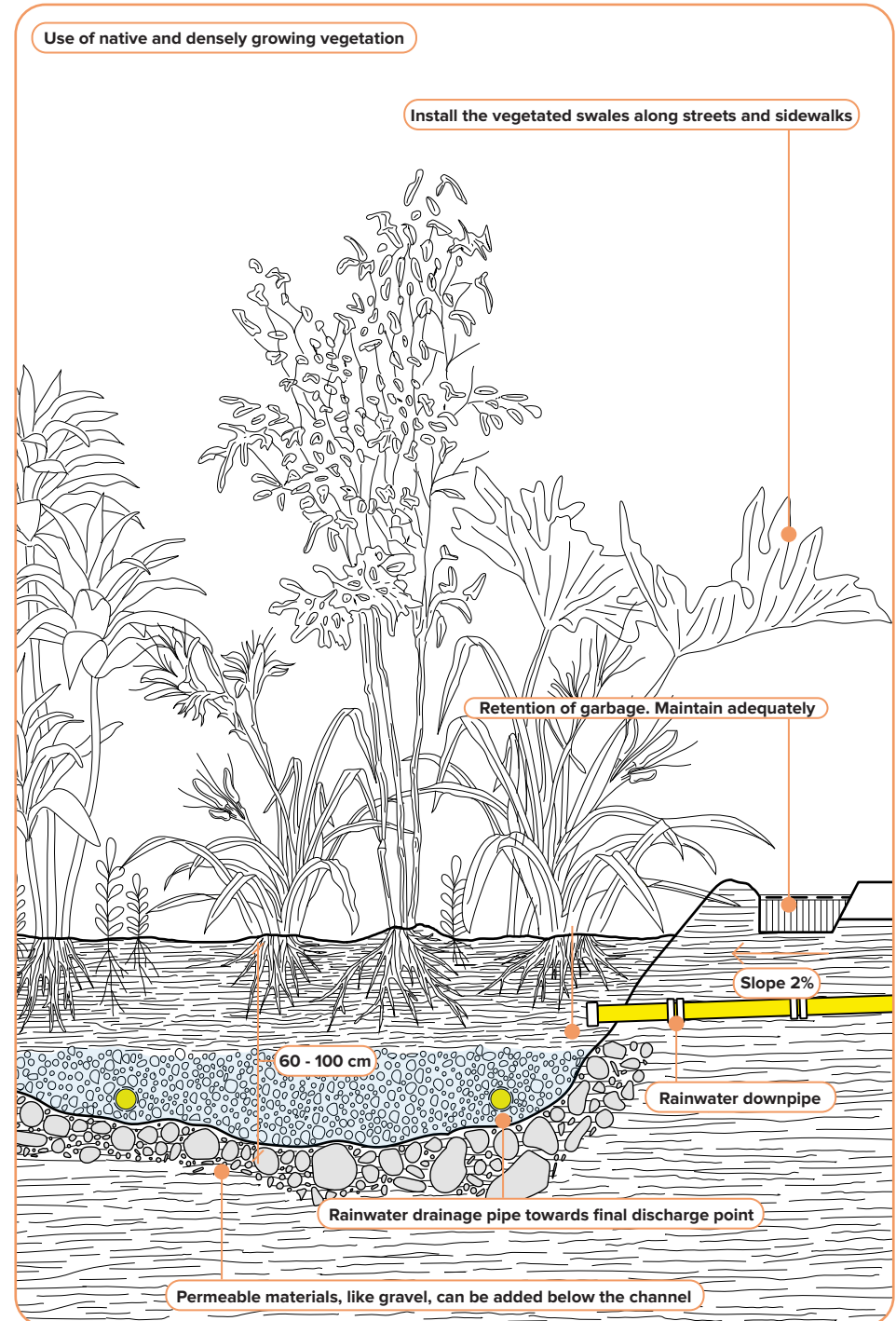




Fig. 10: Community Garden in Bredjing refugee camp, eastern Chad. Nadia Carlevaro, UNHCR 2022.

Good practice

Biofiltration stormwater management model Diepsloot informal settlement, Johannesburg.

To mitigate flood hazards in the informal settlement Diep Sloot in Johannesburg (SA), a model for biofiltration stormwater management was developed. A co-benefit of the project was the creation of jobs and education in landscaping skills for the community. In this light, the model positively impacted the community's empowerment and stormwater management in the informal settlement (Mseleku 2021).

Communal rain gardens in eastern Chad, Central Africa.

For about 20 years, the eastern region of Chad has been hosting many refugees in a rather arid climate. However, during rainy seasons, the low-lying areas near the wadis are often flooded. As a result, communal gardens have been developed. They serve as small buffer zones in the case of flooding while fostering productive use and community resilience. In this context, also the concept of permaculture can support the knowledge and identification with closed water cycles in agriculture. The organic and whole-circle idea of permaculture provides the community with reliable compost and self-grown crops.

Design Your Town (2022)

Example of Roadside planter. Available online at http://www.designyourtown.org/design_detail/planter-boxes/

Design Your Town (2022)

Vegetated Swales. Available online at http://www.designyourtown.org/design_detail/vegetated-swales/

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Guidelines for Integrated Flood Control Design in the Informal Settlements of Cape Town Municipality. A case study of Kosovo, Philippi District.

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Nature-based solutions for hydro-meteorological risk reduction: a state-of-the-art review of the research area. In *Natural Hazards and Earth System Sciences* 20 (1), pp. 243–270. DOI: 10.5194/nhess-20-243-2020.

Overview of Criteria

Type of Intervention:

Nature-based

Scale of Intervention:

Shelter/Block (Bioswale, Rain Garden), Settlement (Infiltration Basin)

Materials:

Bioswales: Sand, Soil, Clay, Gravel, Native Vegetation.

Rain Gardens: Sand, Permeable Soil-Mix, Clay, Gravel, (Small) Native Vegetation, Wood (for Roadside Planters).

Infiltration Basins: Wood, Sand, Permeable Soil-Mix, Clay, Gravel, Riprap, Native Vegetation (incl. trees, bushes, smaller vegetation).

Environmental Impact:

Bioswales and rain gardens support the groundwater quality and provide new habitats for local flora and fauna. However, the soil and vegetation can become contaminated due to the use of fertilizers or highly polluted stormwater (e.g., rubbish and clay). The concentration of pollutants may cause overall permeability reduction, leading to ponding water and diseases. Moreover, invasive species and mosquito breeding might negatively impact the environment due to waterlogging in rain gardens. Possible soil and ecosystem disturbances must be considered during the construction of rain gardens.

Targeted Natural Hazard:

Pluvial Flood.

Targeted Vulnerable Assets:

Buildings.

Strategy Type:

Reduce Hazard Magnitude.

Implementation Time:

Short (1 day - 1 month).

Effect Duration:

Bioswale, Rain Garden: Medium-term (1 year to 10 years).

Infiltration Basin: Long-term (>10 years).

Investment Costs:

Low:

The installation and maintenance costs are comparatively low in terms of time and finances, mainly if native plants are involved.

Maintenance Costs (yearly):

Low (<10% investment costs).



Flood Risk in Humanitarian Settlements: Compendium of Mitigation Measures

Spatial Development and Urban Policy, SPUR

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Cite as

Rohling, Brunna; Kostenwein, David; Gairing, Mona; Al-Mahdawi, Ammar; Schmid, Emilie; Bardou, Eric; Kaufmann, David (2023) Flood Risk in Humanitarian Settlements: Compendium of Mitigation Measures. Zürich: ETH Zürich, UNHCR. DOI: 10.3929/ethz-b-000645680

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