

No waste in Nature





With its new flagship project, the “Genius of Place”, the Western Cape provincial government shows how human problems can be solved by Nature, using the core principles of biomimicry. *Mary Anne Constable* goes on site to find out how this innovative project deals with treating wastewater and stormwater in a Cape Winelands’ informal settlement.

The Berg River is one of the Western Cape province’s largest and most important economic and natural resources, running at a length of 285km from its source in the Cape Winelands and up the west coast where it discharges into the Atlantic Ocean.

The activities in its catchment area are predominantly agricultural and residential, relying heavily on the river as a water resource. Unfortunately, little is done to overcome the negative impacts which contribute to high levels of polluted water entering the river and disrupting its natural ecosystems and vegetation.

“Rivers provide humans and other species with critical ecosystem services,” says Claire Mollatt, of In/formal South, part of the infrastructure design and management team of the Genius of Place (GOP) working in partnership with BiomimicrySA – water is a finite resource and planning is needed for a resilient future.

The Berg River Improvement Plan (BRIP) also recognises the need to upgrade informal settlements as one of its six key tasks because the majority of informal settlements in its catchment area, which have developed due to rapid urbanisation (and lack of available

“The solid waste prototype is based on nature’s ability to recover and use waste through closed loops that generate greater value, by recycling food waste into valuable products.”



Photographs: Mary Anne Constable

Plastics and solid litter collect in gullies formed by polluted grey water and stormwater which run downhill through the middle of the settlement.

formal housing), lack adequate formal infrastructure for sanitation, and collecting and treating grey water and stormwater run-off. Urban stormwater becomes contaminated with solid waste, grey water and other types of pollutants associated with urban activities. These flow into the river, impacting downstream by degrading natural ecosystems. Not only is this an environmental problem, it is a human problem. The degraded quality of the water also affects the communities which rely on the river as an important resource and residents of these settlements experience what many would consider unacceptable living conditions and unhealthy urban environs.

Nature’s lessons

Biomimicry offers a different approach to solving problems by learning from some of Nature’s core principles – the “Genius” of Nature – and replicating them in order to provide unique solutions to human problems.

“Nature solves problems in wonderful ways,” says Charline Mouton, Green Economy Manager at the WCG Department of Economic Development and Tourism. “We have a lot to learn from it.” Nature’s ecosystems have symbiotic relationships between the elements that make them up – they rely and depend on each other to exist as a fully functioning system. But the destructive habits of humans, as well as the “conventional” way of urban living (ie consumption leads

to waste), have led to a breakdown in the relationship between the way humans live in their environments.

Mouton adds that there is no waste in nature. By developing systems that replicate some of nature’s principles and integrating these systems into our environments, we can remove the barriers that humans create. We can find ways to regenerate, revitalise, and restore quality of life in vulnerable communities, while protecting and improving the resilience of our natural resources. Biomimicry solutions are also usually simple and practical, and therefore very affordable. Nature provides us with many “free” resources.

Biomimicry SA partnered John Todd Ecological Design to learn from the existing innovative technology called “eco-machines” which rely on a combination of all five animal kingdoms in various configurations to do the cleaning, helping to restore polluted environments. A typical eco-machine comprises a series of connected tanks that contain different combinations of living aquatic creatures, plants and vegetation to purify the water.

The GOP is the community-based micro level of engagement in cleaning water but it is intended to connect with a large eco-machine or bioremediation plant on the edge of the sports field near the entrance to Langrug. This will connect with an even larger sustainable urban drainage system (SUDS) plant

at the decommissioned Franschoek Waste Water Treatment Works, where a proposal for a mixed use centre is being developed to provide community-based facilities as well as educational opportunities, although this concept is still in the early stages.

Waste nexus

The first phase of the GOP involved developing a feasibility study, which began in early 2013. The aim of the study was to identify opportunities for biomimicry thinking, methods and interventions, and to find a specific water problem faced by informal settlements along the Berg River, to which this could be applied.

It became clear that one of the biggest challenges that informal settlements face is dealing with the “wastewater-stormwater-solid waste nexus”. By focusing on this specific problem, the team identified several key objectives to reduce the water pollution load and to clean water; to upgrade the environment, health and living conditions of the occupants; to manage waste, improve the water quality and environmental balance

of the ecosystems in the Berg River, and to create economic opportunities that support and are supported by the new system. The GOP has established itself as the first African project to apply biomimicry methods.

During phase two, the informal settlement of Langrug was chosen as the specific place to pilot the GOP. Langrug, near the Berg River’s mountain source, is a good place to start in order to improve the quality of water taken from upstream. The topography of the landscape is steep, thus water flows freely downhill towards the river, eroding the surface of the landscape. Jonny Harris, of Isidima Design and Development, who is working on the project, says that “the contaminated water that flows into the existing grey water and stormwater channels of the informal settlement is up to 10 times more polluted than typical domestic sewage, with high levels of faecal pollution”.

Genius of community

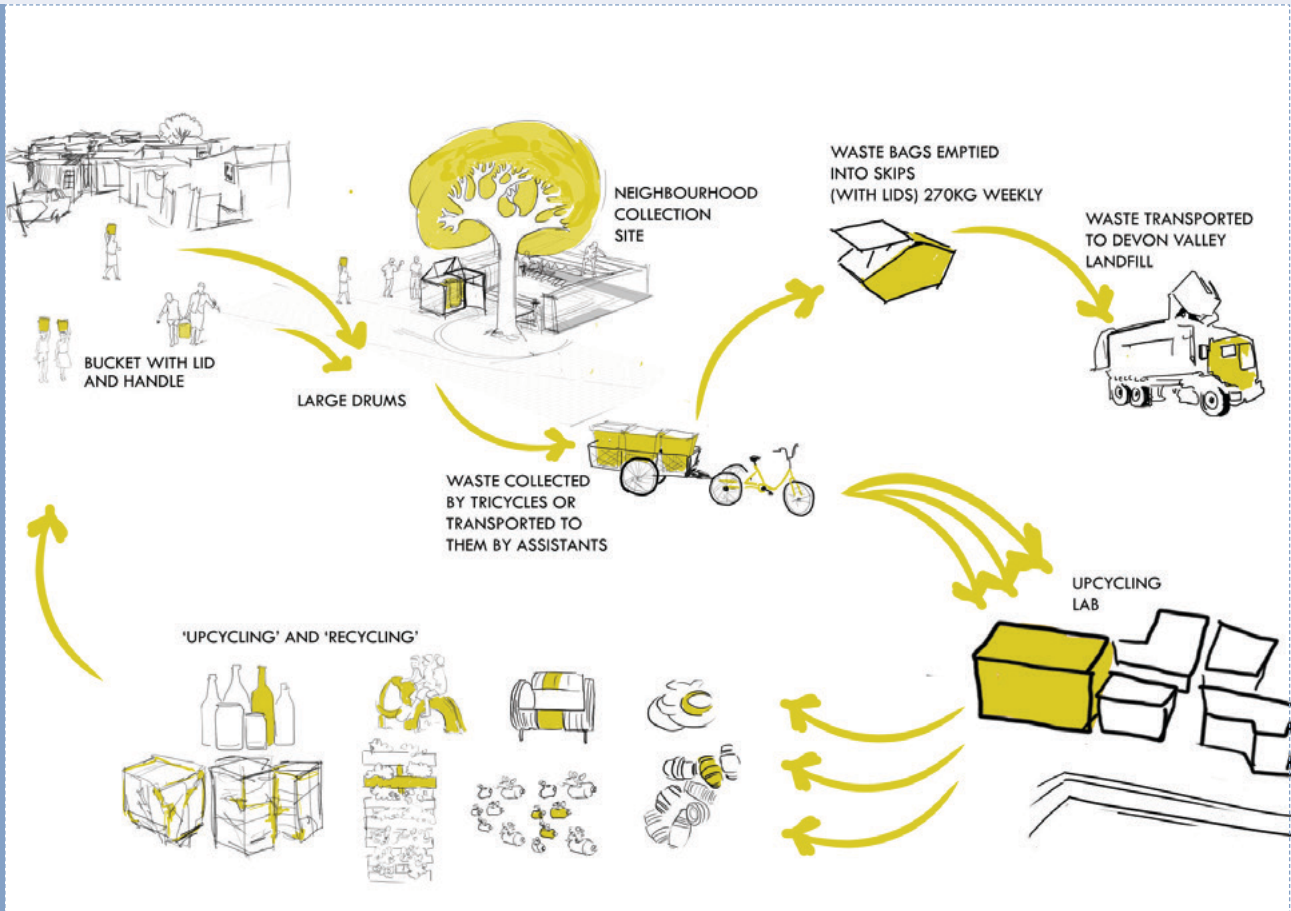
Langrug is a very proactive community. The residents had already come up with their own solution to their water drainage problems by laying

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Some households involved in the waste disposal and grey water prototypes have started greening their surrounds.

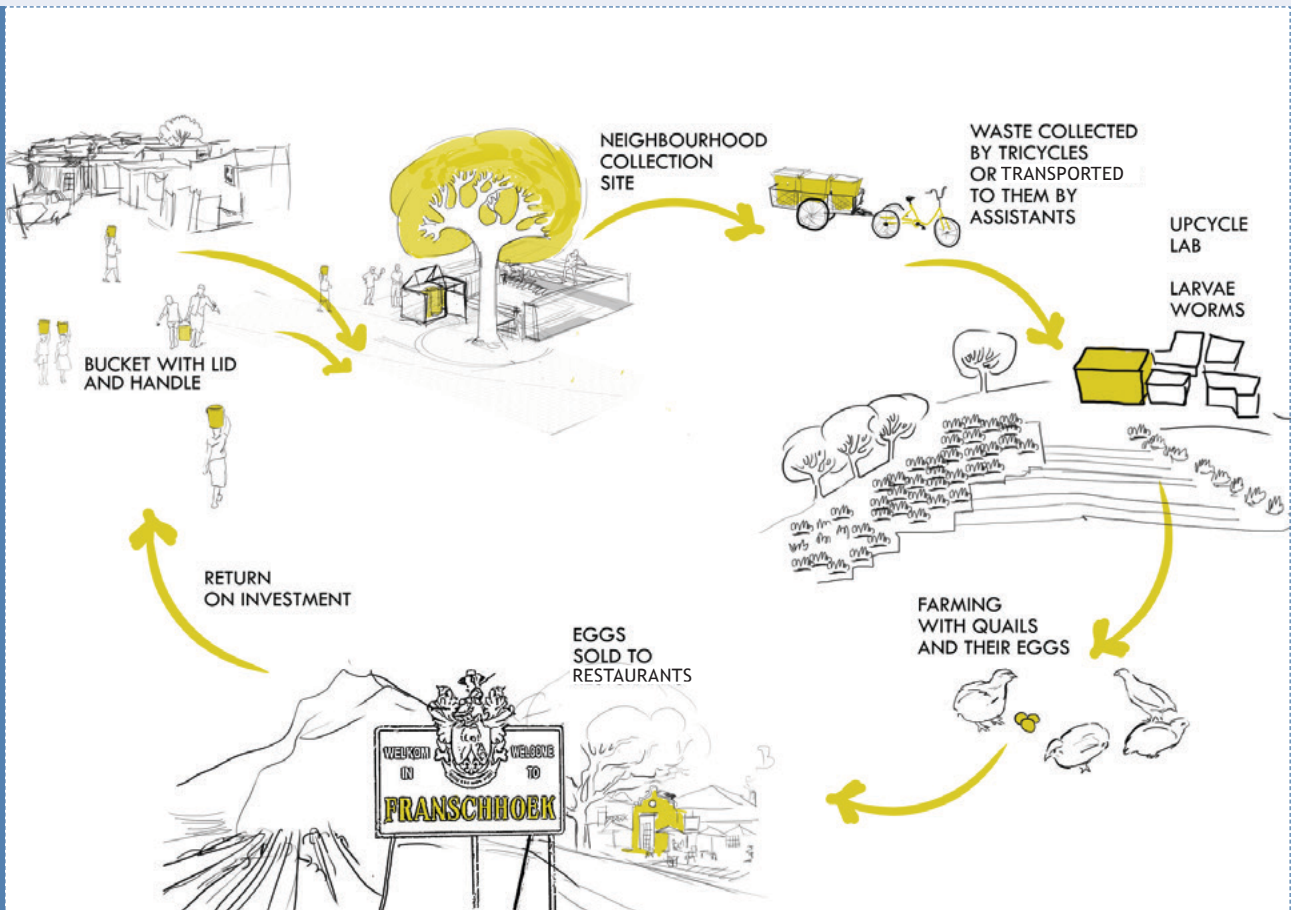
SOLID WASTE FLOWS

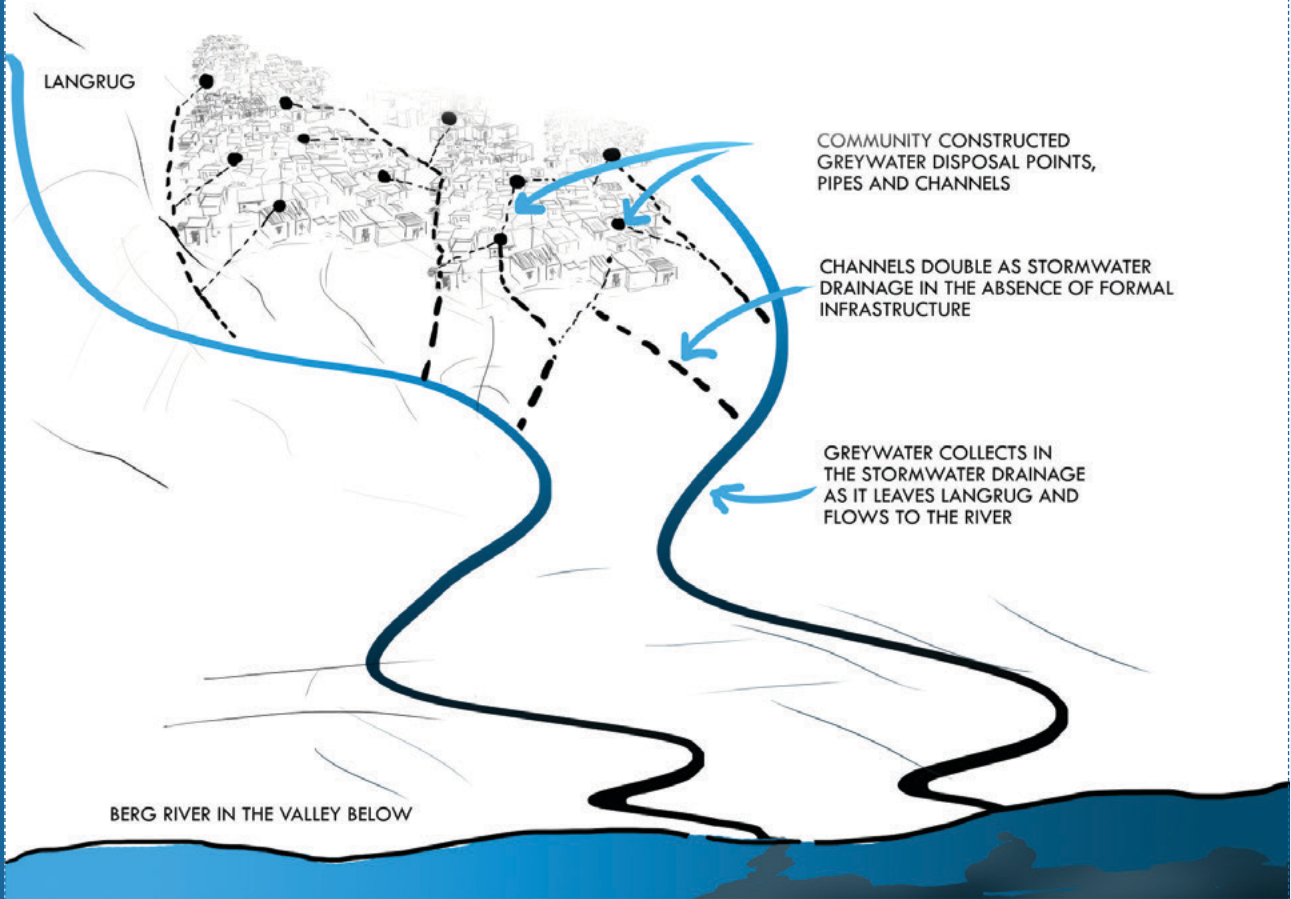


Diagrams: In/formal South

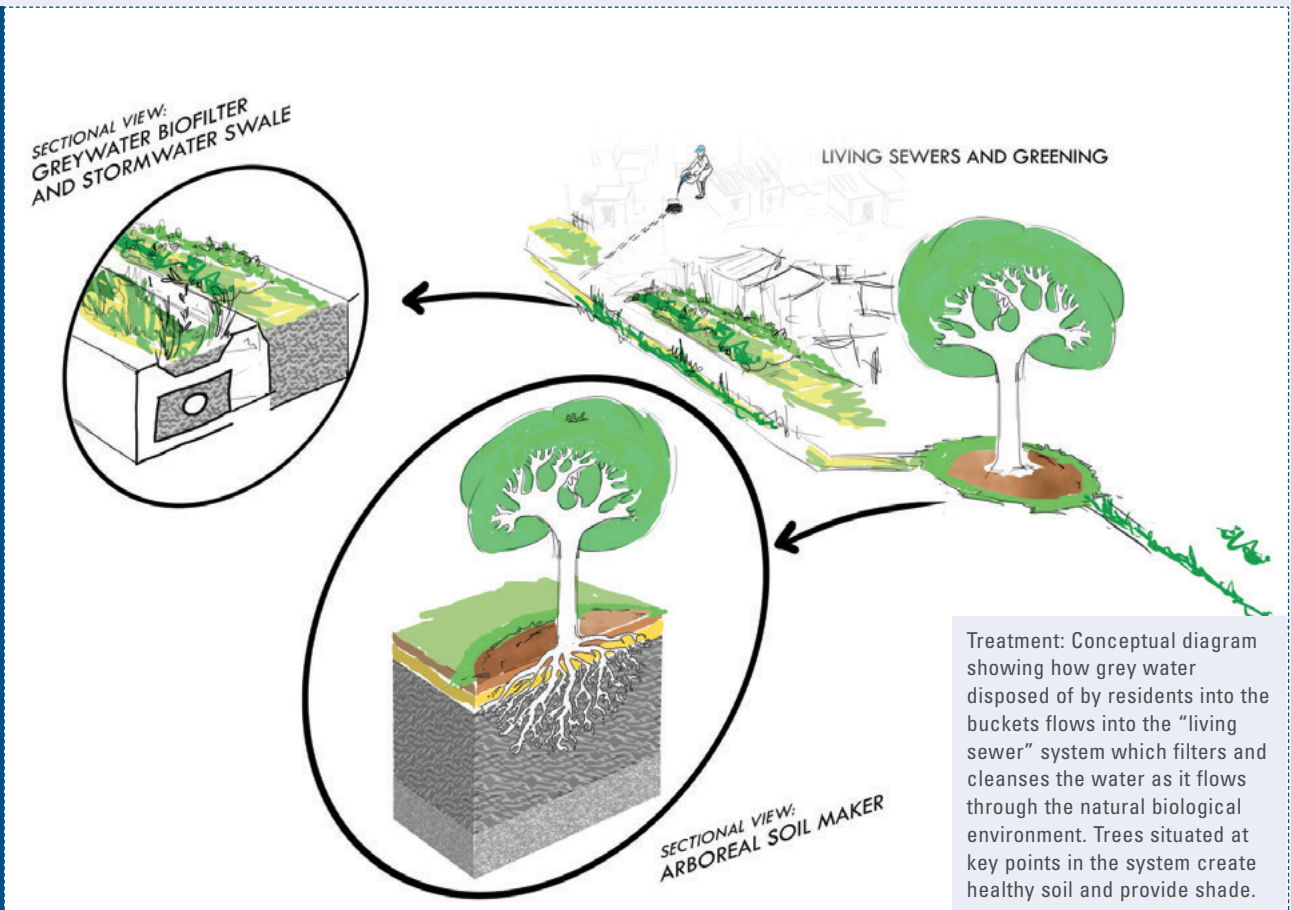
Solid waste flows and upcycling: Conceptual diagrams show how solid waste and upcycling prototypes could work as an "ecosystem".

UPCYCLING





Conceptual diagrams showing the way the grey water and stormwater runs out of the settlement and in to the river.



some underground piping, and it was recognised that the GOP could build on some of these existing systems and the ingenuity that was already present in the efforts of the residents. The community already has several other water and social projects in place that run in collaboration with Community Organisation Resource Centre (CORC), an NGO nucleus for professionals, and other partners at the Worcester Polytechnic Institute (WPI) in the United States.

“The project needs to be nurtured by those that will be the eventual owners of the outcomes,” says Shannon Royden-Turner, also of In/formal South, so community support and engagement are vital. The community needs to be able to maintain its own health and balance.



Residents dispose of grey water into these buckets which then flows into the existing underground pipe system they have installed. The existing network functions inadequately but will be used as a foundation for the new network of “living sewers”.

The project is in phase three – the testing phase during which the key objectives of the GOP are being addressed with prototype solutions. The idea is to replicate strategies that work, both in other parts of the world and in nature but also to tailor them to the specific site conditions, as well as drawing in the technology of the eco-machine. The site for testing the prototypes will involve about 115 households in the settlement.

“The solid waste prototype is based on nature’s ability to recover and use waste in closed loops that generate greater value, by recycling of food waste into valuable products,” explains Mouton. The prototype will also test the development of business opportunities in Langrug where, for



Litter and solid waste collect in a ditch on the edge of the existing sports field near the entrance to Langrug, where the new bioremediation plant is to be built.

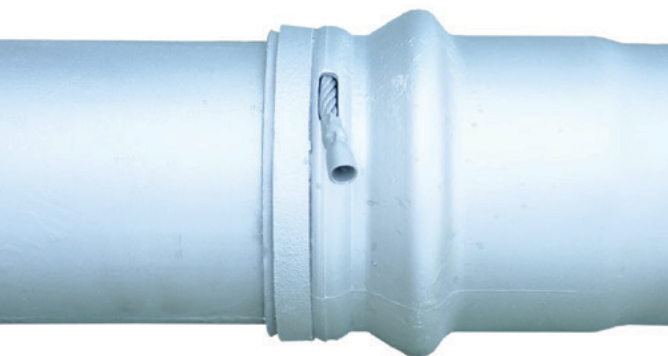
Upcycling vs downcycling

Upcycling is recycling by reprocessing old or waste materials to add value by creating new useful materials or products of higher quality, or for better environmental value.

Downcycling is the process of converting waste or useless products into materials of lesser quality, diminished value and reduced functionality. Downcycling aims to prevent wasting potentially useful materials, and to reduce the consumption of virgin raw materials and of energy.

These concepts first appeared in the mid-1990s and have become parts of the recycling lexicon after being used by authors William McDonough and Michael Braungart in their 2002 book entitled *Cradle to Grave: Remaking the Way We Make Things*.

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'Genius of Place'

The Western Cape Government (WCG) in 2013 started looking into the feasibility of using biomimicry principles for a location-specific project in one of the informal settlements along the Berg River, in order to solve some of the settlement's biggest challenges – dealing with wastewater, stormwater and solid waste.

Thus the "Genius of Place" (GOP) project was born in a small settlement

called Langrug, near the Franschhoek mountains and close to the river's source. The project falls under the WCG's 110% Green Initiative, a provincial premier-led drive to encourage organisations to become involved in and link up with the WCG's Green Economy Strategy Framework.

The GOP aims to find alternative ways to solve environmental problems while at the

same time stimulating economic opportunities. The project is linked to the WCG's Berg River Improvement Plan (BRIP) in order to integrate it into a larger framework and provide techniques and solutions which could potentially be similarly applied in other problematic places along the river.

The BRIP follows a collaborative "systems approach" whereby all tiers of government

(national, provincial and local municipalities), local communities and nature itself work towards the common goal of improving the water quality of the Berg River. The project, although not yet in the construction phase, is already starting to yield positive results, bringing new life into the settlement – restoring a dignity that reflects the natural beauty of its picturesque setting.

example, households will be responsible for separating their general landfill waste from their food waste, which will be treated with *bokashi* (Japanese for "fermented organic matter") effective micro organisms that help fermentation. The food waste will be collected and transported by tricycle to a communal waste centre for upcycling (see box left).

Another opportunity in processing food waste involves using fly larvae and red worms which can be sold as high protein feed to chicken and fish farmers in the area. A utility area, where waste is collected and where there is a sink for washing clothes, is also a public space with trees and seating – the acts of waste disposal and doing laundry provide moments of social connection. A second phase will look at separating recyclable waste in other ways, thus generating other economic opportunities.

Grey water swales

The grey water prototype has many advantages. It provides a method for separating polluted grey water from stormwater, cleaning and treating the water to improve the quality of soils, and to green the settlement. Micro wetlands will be coupled with stormwater swales that create a "living sewer". Plants help to filter, clean, slow down the flow, and break down waste in the water.

The swales are positioned along vertical routes between the houses and improve the environment quality and health of the settlement. Each household will dispose of its grey water at specific

disposal points – essentially buckets sunk into the ground and connected to underground pipes – based on the existing underground piping system previously installed by the community. The swales are designed to slow the flow of the water to reduce flooding. Trees which interconnect at points along the sewer, draw nutrients from the water, while filtering it, and giving back by creating healthy soil. The wastewater and storm water prototype will treat about 6 000 litres of grey water a day for the 115 households.

Healthy future

There are many lessons to be learned from the project which can be applied to other river clean-ups in South Africa. The GOP shows us how, on a micro level, simple and practical natural solutions can be used to solve major human problems. The linking with the overarching plan of the BRIP means that these solutions, once tested and proven successful, can be applied on a macro level in other problem areas along the river.

Furthermore, it is not only a solution to an environmental problem but also a positive activator for collaboration and social upliftment by creating economic opportunities for the benefit of local people. The collaborative actions between all role players and stakeholders show that answers can be found by connecting with people and with nature. Biomimicry shows us that nature can become an inspiration, and if we steward and serve it well, it will serve us well in return. ●

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