Lynedoch receives a new wetland-

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29 July 2014

"What if becoming who and what we truly are happens not through striving and trying but by recognizing and receiving the people and places and practices that offer us the warmth of encouragement we need to unfold?" - Oriah Mountain Dreamer

There is certainly something special about being fully connected and aware of what happens to our waste as we flush it away. It is clear that there is no magical place called "no- where" that deals with our waste resulting in it being "gone" forever.

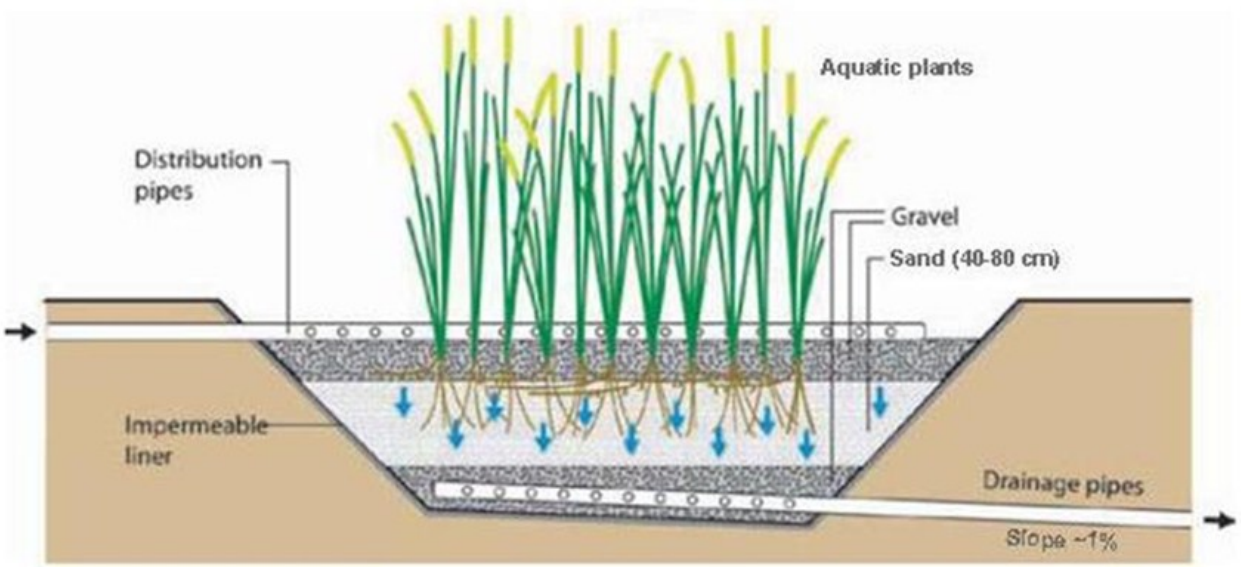
It would seem there an apparent disconnect between people and the environment in which we are embedded. It is therefore a privilege to be part of a community where the people living in the space are well aware of how and where their waste is processed.

The Lynedoch Eco Village is one such community which recycles 100% of its waste water, and reuses it as flushing water in the toilets again within the very same community. The community consists of the Lynedoch Primary school, with approximately just over 300 children the Sustainability Institute and all its daily visitors and post graduate students, a crèche and baby centre with approximately 55 children and 29 families that live within the Lynedoch Eco village.

The following section will be a brief look into the how the current waste water system at Lynedoch operates as a means of servicing the community.

Each house has a septic tank, from which sewage comes into the biolytix system through a pipe. The biolytix is a tank that is divided in different horizontal layers to extend the waterway. Earthworms burrow through these layers, keeping it open, free-draining and aerated while the worms take the nutrients out of the wasted water. The nutrients are converted into humus (a nutrient-rich soil) and the purified water ends up at the bottom of the tank. It is then pumped into the vertically integrated wetland which is a planted filter bed (2.5m deep) for secondary or tertiary treatment of wastewater (grey-water or black-water).

Pre-treated wastewater *(e.g.* from a septic tank and biolytix tanks) is distributed over the whole filter surface and flows vertically through the filter. The water is treated by a combination of biological and physical processes. At the bottom of the filter, there is a drainage system which collects the treated wastewater, made of various levels of gravel is used to construct the filter body (see image below). The filtered water of a well - functioning constructed wetland can be used for irrigation, aquaculture, groundwater recharge or is discharged in surface water (we reuse it for flushing our toilets in turn saving 40% of the municipal water used in the household).



Challenges in the system

The current system has held the community as an integral part of the waste water treatment system on-site. However there have been some challenges along the way, which have sometimes led to the system not functioning entirely well. Reasons being;

In essence, nothing was wrong with the design of vertically integrated wetland. It was merely a case of the wrong design in the wrong location. Vertically integrated wetlands are prone to blockages when there is incorrect sand specification and over loading and lack of management (lack of alternation).

The wetland is made of four quadrants which are meant to operate alternatively, this allows for the thorough drainage in one quadrant as water filters though the remaining three quadrants. Therefore, one would need to manually alternate the quadrant in which the water is filtering through. However due to the way the space is which the vertically integrated wetland is situated, it is embedded in perfect clay, which then retains the water instead of letting it drain through the system. Resulting in it being continuously filled with and especially in winter. The images above depict the interventions made to the pool of water that rests in the perfect clay. There is so much water there, work on the space cannot commence otherwise. Maybe a lesson to be learnt here would be to simply not try work around nature but with nature. Here we are, attempting to work in a space that is naturally filled with water in the winter and nature is simply granting us a hard time, the original plan to the new wetland has even had to change slightly. Large rocks have been brought in to solidify the space. Above the rocks, a layer of calcrete sand (similar to dune sand) has been placed to form the base layer on which the road and the wetland will be constructed.

Regardless of the challenges we had with the old wetland, the universe has a very peculiar way of responding to such things by simultaneously providing opportunities for the repair and/or allow for transformation. Lynedoch is therefore getting a brand new wetland as part of the waste water management system designed by Maluti Water.

By learning from these deep design lessons, we can model innovative strategies, measure our designs against these sustainable benchmarks, and allow ourselves to be mentored by nature's genius using Life's Principles as our aspirational ideals." - Biomimicry Design Lens

Power construction and Maluti Water and Fanie Swiegers representing the HOA hard at work.

The new Lynedoch access road

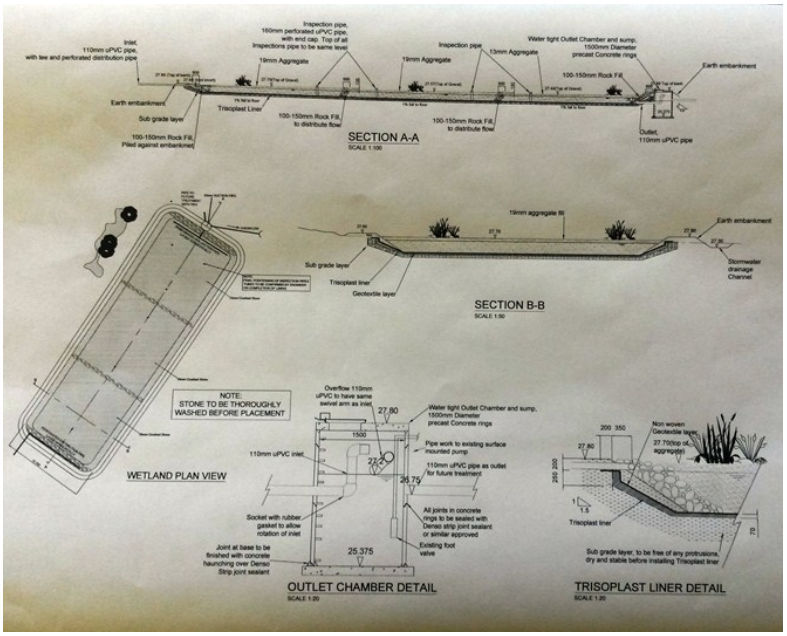
Power Construction has been tasked to widen Baden Powel, which is the road that goes past the Lynedoch property. In the plan there is a new road to be built currently referred to as the new Lynedoch Access road. This would translate into the rail way lying in between the two roads (i.e. Baden Powel and new Lynedoch access rd). This means, all railway crossings between Vlaeberg and Vlottenberg roads will be closed off and entry into the Lynedoch property will now be through the new Lynedoch Access road and not over Annandale Rd, as it currently is.

This new Lynedoch Access rd will be a two way road, and this ultimately means that part of the woodlands as well as the current wetland will be encroached upon to create space for the new road. This has resulted in the need to decommission the vertically integrated wetland and the redirecting of sewage flows into the soon to be built horizontal flow wetland (which will only be about 60cm deep) but in order for that to happen, the food gardens also unfortunately had to burn the brunt (see image below).

The horizontal flow wetland will be slightly lifted from the ground to avoid the same winter pool of water from occurring again as mentioned in the challenges.

The bed will be lined with a layer of Trisoplast to act as an impermeable liner that will prevent leaching. Small, evenly sized gravel is most commonly used to fill the bed. The stones help to limit clogging. This will be explained in detail in the different layers that form the wetland.

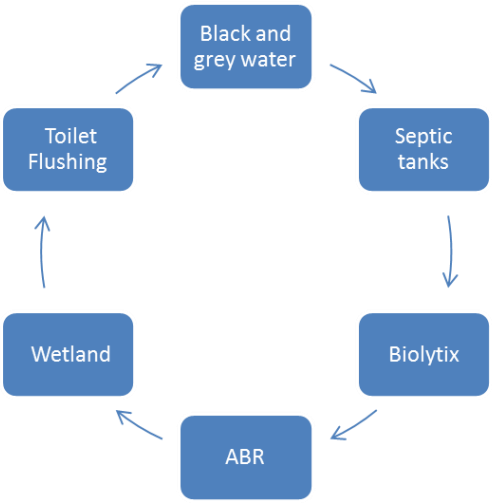
What differentiates a vertically integrated wetland to a horizontal flow wetland is merely the direction in which the water in the system flows as it goes through the filter. In a vertically integrated wetland the water enters the system from the top and filters down through various levels of gravel to the bottom then exits the system as depicted in the example on page 1. However the new wetland will have water entering through one side of bed filtering across the bed and exiting the system on the other side.



Current plan of the new horizontal flow wetland.

How the new system will function

The process for every building except the SI main building /school and the guest house



The new system is nearly the same as the old one, however we now have an anaerobic baffle reactor (ABR) system, which is understood to be an improved septic tank because of the series of baffles under which the waste water is forced to flow . The increased contact time with the sludge in each chamber results in improved treatment of the waste water.

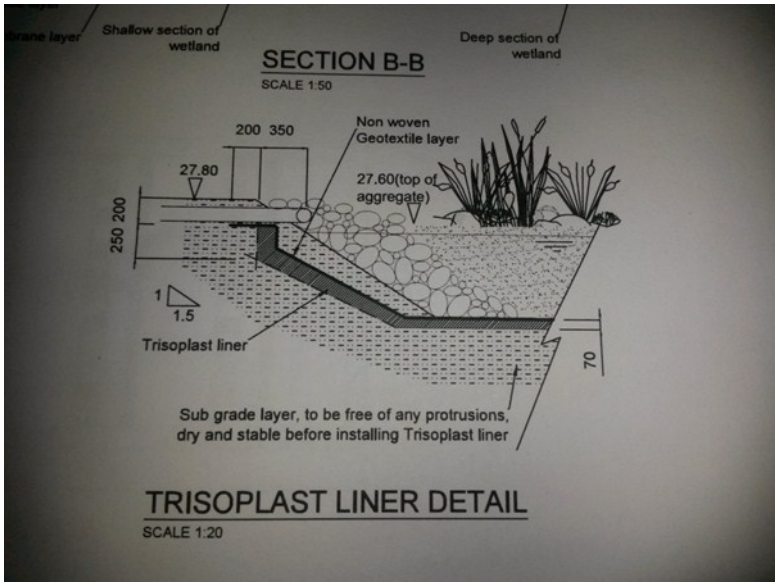
When a toilet is flushed the waste water will now go to a septic tank, then to the biolytix and into an anaerobic baffle reactor via gravity as it is built on a slope, and then through the wetland. In the outlet chamber of the wetland there is pump to pump water into the tanks where it will be stored prior to back into the system for flushing the toilet again.

The ABR system also has a gas vent in its outlet chamber, through which we will be able to tap out some of the biogas produced and use it as cooking gas.

The waste water from the guest house and the main building however are not connected to the biolytix. Therefore all sewage from these two buildings has been redirected to flow in front of the SI main building directly to the anaerobic baffle reactor and then through the wetland continue join in the system as well.

The image on the right is the anaerobic baffle reactor being made. Currently just looking like a cage. That is the reinforce steal prior to the cement being poured to form the outer walls of the ABR.

The different layers that make up the horizontal flow wetland



The image above is a cross section of the drawing of the horizontal flow wetland . The following section will be elaborating briefly on each layer;

Calcrete is a calcium rich soil (dune like sand) has been placed as a base layer.

Trisoplast liner is a patented mineral barrier, which was developed in the Netherlands by Trisoplast Mineral Liners. Its outstanding performance is achieved on-site by simply mixing the special bentonite-polymer component with a mineral filler, e.g. sand. The mixture is installed as a robust layer and can be covered immediately by a layer which provides the necessary confining pressure. After finishing the construction, the Trisoplast layer absorbs the first water from the environment that reaches the layer. This causes the bentonite clay to swell and form a network of chemical bonds with the dissolved polymer to create a strong, dense hydrogel structure. Whereas Trisoplast predominantly gets its mechanical strength from sand, the bentonite-polymer gel provides the necessary flexibility and hydraulic performance which is 100 to 1000 times better than with traditional mineral barriers.

TRISOPLAST
MINERAL LINERS

Geotextile which is a semi-permeable fabric. This is to strengthen the liner provided by trisoplast.

River Rocks to allow for even distribution of water through the bed.

19mm Stones to fill the bed

Bioremediation done by Natasha Rightford

To finish the construction of the wetland Natasha Rightford will be doing some **bioremediation** of the domestic waste water, by creating an indigenous working wetland for us to enjoy. Consisting of 17 species of plants and a total of 1138 plants. The aim is to have all five life kingdoms existing within the wetland.
The five kingdoms consist of ; bacteria, algae, fungi, plants and animals.

Above the stones which fill the bed, Natasha will be creating pathway to enable access to the wetland for maintenance procedures as well as simultaneously creating a space for observation and sampling as this is a institution .

The pathway is to be made up of stone slabs with three benches and four piezometers

There are five entrances into the wetland which are made from the stone blocks ascending in steps.

Mycoremediation is a form of bioremediation - it is the process of using fungi to degrade or repossess contaminants in the environment . One of the primary roles of fungi in the ecosystem is decomposition performed by mycelium.

As the waste water enters the wetland a 12 meter long burlap sack will be filled with spawned substrate of the following species: **Stropharia rugulosa annulata, Pleaurotus ostreatus and Irpex lacteus**

These are able to trap e.coli, phosphorous and nitrogenous wastes up front.

After fruiting many times this substrate might need to be changed, however, much is unknown as to how the mycoremediation will work and needs to be ascertained over time e.g. will the mycelia spread into the wetland to act as an added filtration process?

Phytoremediation describes the treatment of the environment through plants without the need to excavate the contaminant material and dispose of it else where.

The plants to be used are divided into 3 categories – **wetland, marginal wetland and marginal dry plants** – as there are differing root zones and depths that are involved in housing a host of micro-organisms that make up the food web. We want our food web to be as robust as possible to deal with the many contaminants they are challenged with transforming. Diversity of plantings ensures resiliency of the eco-system we are intentionally engineering to ensure minimal human impact on the surrounding Eerste River riparian zone

Wetland:
Chondropetalum tectorum, Cyperus textilis, Prionium serrate.

Marginal Wetland:
Cliffortia obcordata, Cyperus albostriatus, Cyperus prolifer, Ficinia lateralis, Juncus kraussii, Kniphofia praecox, Wachendorfia thyrsiflora, Zantedeschia aethiopica

Marginal Dry:
Eriocephalus africanus, Helichrysum patulum, Saliva Africana, Salvia lanceolata, Stoebe plumosa, Ruschia macowanni

The plants shall be delivered to the SI on the new Moon in Virgo, Monday the 25th. August 2014 and co-creation shall take place over the next 2 weeks until full moon on 9th September 2014 – a perfect time to celebrate long awaited transformation, to honour one another and share our gratitude's and together bless the working/healing space we have created.