Shoreline remediation and floating wetlands

Example of eroded shoreline at the Hartbeespoort Dam

INTRODUCTION

Development of criteria for habitat reconstruction and rehabilitation aims to deliver design criteria for habitat reconstruction and rehabilitation in the littoral and riparian zones for the following components:

- Floating wetlands (littoral zone and in open water in quiet bays)
- Lake bank vegetation (including terrestrial shrubs and trees) (riparian zone)
- Placement of gravel and rubble beds (littoral zone)
- Placement of additional structure in the littoral zone, such as large rocks.

Habitat reconstruction and rehabilitation in the context of the Hartbeespoort Dam refers to the placement and replacement of cover for aquatic biota. Cover in terms of rocks and plants, etc, will provide habitat for biota to feed from and to utilise as habitat and protection. The aim of habitat reconstruction and rehabilitation is:

- To provide habitat for spawning, feeding, establishment and the succession of all aquatic biota (i.e. epi-biota, benthos, algae, aquatic macrophytes, fish etc).
- To achieve overall improvement and an increase in diversity on all biological levels to give effect to the aquatic ecosystem reserve in terms of the National Water Act.

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- To develop preliminary Resource Quality Objectives for the Hartbeespoort Dam to incorporate the aquatic ecosystem targets (aquatic diversity).
- To consider the preservation and optimisation of rivers, spruits and drainage lines with their associated riparian vegetation and flood zones (in additional to the Hartbeespoort Dam).

METHODOLOGY

Shorelines that have suffered negative impacts as a result of stormwater erosion, vegetation destruction and the use of non-selective herbicides to control alien invader species are remediated in terms of this key focus area. Habitats, which replicate wetland ecosystem functionality and resemble wet seepage zones, are created to enable wetland plants to flourish. This seepage zone typically includes a 'buffer' zone, which filters excess nutrients and pathogens in stormwater runoff.

Floating wetlands are also aimed at replicating wetland ecosystem functionality, thereby extending and maintaining the functionality of shoreline vegetation during fluctuating water levels. The aim is to mimic what occurs in nature, as in the Okavango Wetland for instance, in terms of naturally buoyant floating mats. These floating wetlands become a link from deeper water to shallow water for fish fry to travel – thereby becoming a vital 'aquatic nursery migration zone'.

Certain prototype designs have been trial-tested at the Hartbeespoort Dam Kurperoord demonstration site. For floating wetlands, the objective is to establish designs which comply with two key aspects, namely functionality and stability. Functionality includes above-the-water vegetation growth, as well as below-the-water root growth. Biodiversity is another key component in terms of functionality, as microbes, beneficial bacteria and fungi colonise the roots and matrix – all of which play an active role in cleaning the water. Stability is vital, as the floating wetlands need to be firmly anchored to withstand very high winds and wave action.

Shoreline rehabilitation trial prototype designs at the Kurperoord demonstration site utilise different stabilisation methods, which include hessian, netting and tyres. Once the prototype designs have been approved, floating wetlands and shoreline remediation will be implemented on all state land (i.e. Kommandonek, De Rust, Oberon, Schoemansville and Ifafi, etc). In conjunction with this, the required documentation for implementation, such as operational best practice (OBP), field notes and concept design documents will be compiled. These will then be rolled out to shorelines around the dam within the legal framework of the Department of Water Affairs' Integrated Water Use licences requirements, the Department of Agriculture, Conservation and Environment EIA (Environmental Impact Assessment) requirements, and the Madibeng Municipality bylaws to all land owners along the shoreline. The intended roll-out areas include, as a first priority, the Hartbeespoort Dam, then the catchment, and at a later stage other eutrophic impoundments in South Africa.

The prototypes are monitored on an on-going basis in respect of the growth patterns of the various vegetation species above and below the water. In addition, a species' ability to propagate sideways, its natural buoyancy, and its ability to flourish at local temperatures and withstand frost, are monitored. The components in construction and assembly are also documented. The combined data is used in compiling lessons learned, and designs are adapted accordingly.

TRAINING

The floating wetland team receives training on an on-going basis through step-by-step explanations about floating wetland and shoreline construction methods, and about biodiversity (vegetation and wildlife species).

Site requirement field notes capture and incorporate information to assist with construction and maintenance. Copies of all the field notes are supplied to the floating wetland team and other interested parties.

PROTOTYPE DEVELOPMENT AND CONSTRUCTION PROGRESS

Shoreline rehabilitation

Conceptual designs for the Ifafi shoreline rehabilitation trial sites were compiled in 2008/9, and since October 2010 various prototypes were constructed employing different stabilisation methods, which include hessian, netting and tyres. To date a total of 8 540 m^2 of shoreline has been rehabilitated – at Kurperoord, Kommandonek and Ifafi.

Floating wetlands

Since 2008, various trials on floating wetlands have been performed. In October 2010 the tag numbering system, in

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Close-up of floating wetland grid

terms of actual construction and components within the numbering, was revised and all the floating wetlands were tagged.

To date 5 000 m^2 of floating wetlands have been constructed and launched at Kurperoord, Kommandonek, De Rust, Lakeland, Leeuspruit and at the dam wall.

Quality control is essential, so the criteria for floating wetland evaluation include: checking bamboo growth nodes to ensure that no water enters the sealed end and causes rotting, ensuring that all bamboo joints are tied together securely with steel-rope, and that PVC-coated wire-mesh cable ties are attached (rusting remains a big concern), and silicon-sealed 'screwits' are placed at all mesh cut ends. To stop plants from washing out at the sides of the floating wetland a zigzag of steel-rope is attached

Floating wetland being prepared and positioned along the shoreline

Launched floating wetland fulfilling its purpose – longer periods of clear water have been experienced since mid-2009

on the sides between the top and bottom frame. Lastly, regular monitoring of the vegetation growth pattern, as well as of the invertebrates present, is undertaken.

Maintenance

Regular maintenance is done on shorelines and floating wetlands, and alien invader species like hyacinth and snakeroot are removed. Litter and debris that accumulate are removed and any stormwater damage is repaired.

Pecanwood Estate

The programme established a working relationship with Pecanwood Estate when they agreed to participate as a 'beta' site – a Safety Health Environment and Quality Management (SHEQ) term. In terms of this, Pecanwood adopted the Waste Minimisation and Recycling OBP, as well as the Optimisation of In-lake Dams (including stormwater dams and manmade wetlands).

Pecanwood Estate was used as a model to compile the OBP concept site requirement field notes and fact sheets, and to capture aspects like 'implementation challenges' to which solutions are added. Field notes and fact sheets compiled to date include:

- Marina island wetland and shoreline re-vegetation fact sheet
- Wetland bird identification fact sheet
- Wetland golf estates and estates aims and objectives fact sheet
- A wetland poster

CONCLUSION

Many different processes and procedures have been put in place to optimise floating wetland production, including the following:

- Wetland vegetation identification fact sheet
- Wetland vegetation layout diagram for proposed maintenance and management
- Urban stormwater guidelines (four)
- Jetty construction OBP concept
- Golf course OBP concept
- Shoreline activities (algae and hyacinth removal) OBP concept
- Biomass removal: vermiculture wormery for residential use OBP concept
- Floating wetland quality control OBP concept
- Biomass removal: vermiculture wormery tyre installation OBP concept.

Throughout the pilot process many lessons have been learnt regarding technical aspects of the designs, and these have been incorporated into new designs in terms of:

- **Components:** netting, PVC-coated galvanised mesh, steel-rope and frames
- **Plant species:** papyrus, bulrush, giant sedge and wetland mix
- **Construction:** organic mulch, plant density, seed sausages, plant pockets, seed blankets, upright placing of plants, bigger frames, nursery designs, diamond and square layouts, organic material and anchoring
- **Production:** templates, processes and procedures such as a 'Production Wheel'.

Shoreline remediation and floating wetlands will be rolled out to surrounding land owners and other dams in the near future. □

Source:
http://www.saice.org.za/downloads/monthly_publications/2012/2012-Civil-Engineering-August/#/0