



**GREEN INFRASTRUCTURE  
FOR DISASTER RISK  
REDUCTION:  
THE ROLE OF OUR WETLANDS**

By Debbie Fordham

# GREEN INFRASTRUCTURE

- Naturally functioning ecosystems that generate or deliver valuable services to people.
- Our rivers and wetlands are an example of ‘green infrastructure’
  - ✓ naturally provide water purification services, and
  - ✓ mitigate against flood damage.
- Must be effectively managed and maintained in a healthy ecological condition.
- Like man-made infrastructure, green infrastructure needs maintenance and investment.
- Potential to decrease flooding and flood damages, and improve water quality.
- Investing in our ecological infrastructure, such as through river and wetland management plans, rehabilitation interventions, research, monitoring, and alien clearing (amongst other initiatives) is essential.

# DISASTER RISK REDUCTION

- Wetlands directly reduce disaster risks through the natural regulatory processes.
- Healthy and well managed = a buffer or protective barrier from the impacts of hazards, such as floods.
- Changes in climate are expected to exacerbate the impacts of current pressures on wetlands.
- Integrating wetlands as green infrastructure for disaster risk reduction increases resilience of local communities .
- Degradation of wetlands reduces resilience.

Green Infrastructure investments

Healthy wetland

Capacity for wetland functions

Slows flow velocity

Flow attenuation

Regulatory Ecosystem services

Water purification

Flood mitigation

Erosion control

Biodiversity and fire refuge for biota

Benefits

Long-term sustainability

Resilience

Disaster risk reduction

# Urban impacts

- ▶ Common threats to the functioning of these ecosystems include alien invasive plant infestation, damming, vegetation clearing, and habitat loss as a result of development and service infrastructure constructed within and around aquatic habitat.
- ▶ Almost all of our urban wetlands have been subjected to one or more human impact and very few are in pristine condition.
- ▶ The urban area is expanding in extent, as well as densifying, due to increasing population and economic growth. The encroachment of roads and housing onto floodplains and wetlands can dramatically alter the flow rates, water quality and sediment regimes of watercourses.
- ▶ The greater the extent of hardened surfaces (e.g. roofs, parking lots etc.), the lower the infiltration of stormwater and therefore the greater the surface runoff and increase in flood peaks.
- ▶ A change in water distribution generally results in altered wetness regimes, which in turn affect the biophysical processes and the vegetation patterns.



# WETLANDS FOR WATER PURIFICATION

Wetlands naturally provide water purification services similar to those delivered by man-made water treatment infrastructure.

Without this ecological infrastructure the natural services would need to be replaced with potentially costly engineered infrastructure.





- ▶ It has been subjected to significant degradation due to land cover and land use changes associated with urban development, plantation, damming, and alien invasive tree infestation. The Garden Route Dam is a significant impoundment that supplies George with water for domestic use. It has caused the inundation of a significant reach of the Kat River destroying riffle, rapid, and riparian zone habitat. It has completely obstructed the movement of aquatic fauna, influences the water quality characteristics, and the movement of sediments. Additionally, the river and dam receive pollutants from the urban area.

- ▶ The Kat River is a perennial stream with its source in the Outeniqua Mountains above the town of George. It flows along the edge of the developed area and then becomes dammed shortly upslope of the confluence with the Swart River to the south. It is fed from surface runoff and groundwater inputs from the mountains that collect in the system and flow into the Garden Route Dam.

# TRANSFORMED & MODIFIED OR UNMANAGED



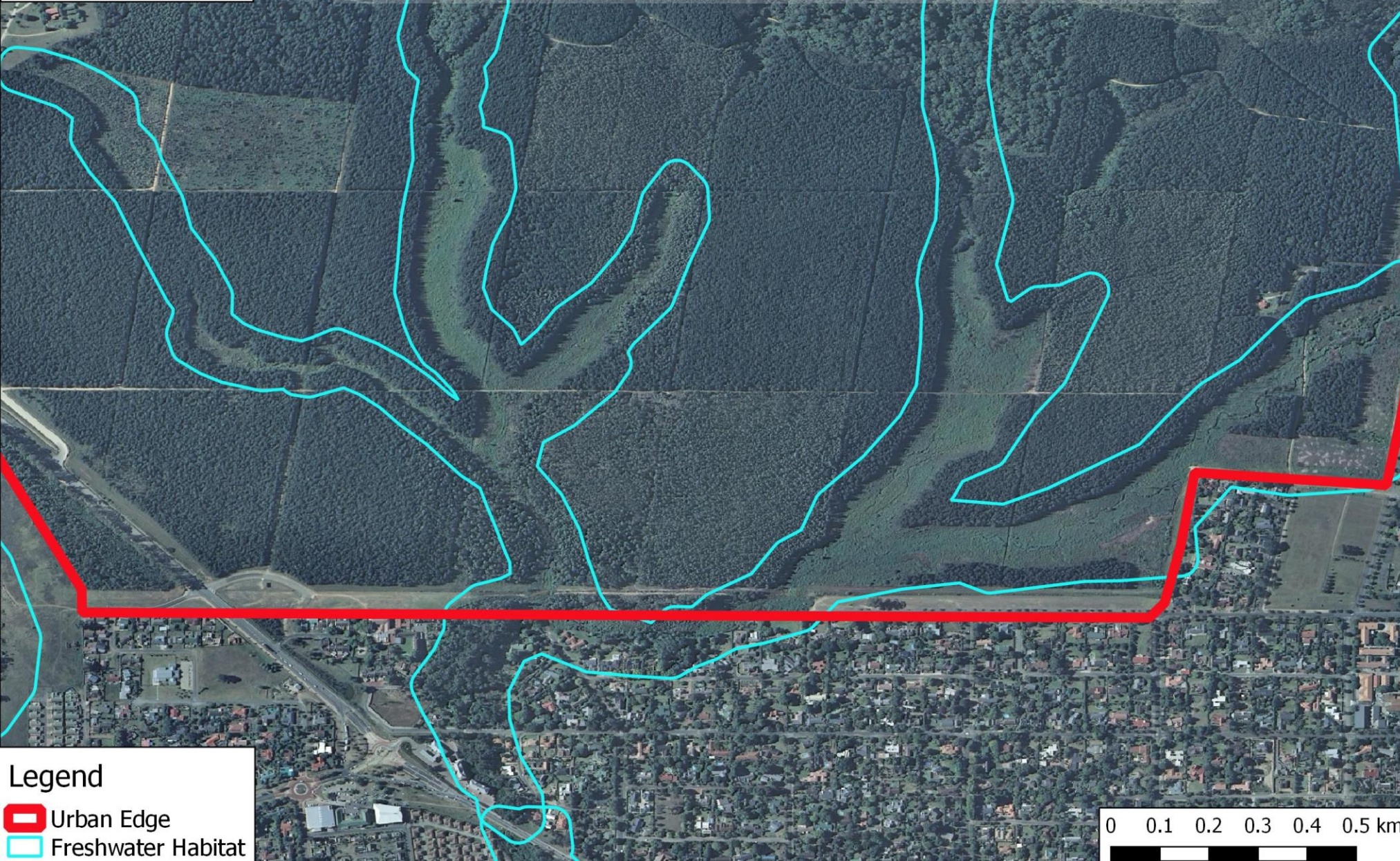
Modified wetland habitat of the Kat River from urban encroachment - maintained lawn replaces natural wetland vegetation



Reach of wetland habitat infested with alien invasive plant species





# WETLANDS FOR FLOOD MITIGATION

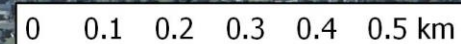


- Large wetlands
- diffuse flow
- good integrity  
(bordering Heatherlands residential area)

This habitat is lost downstream within the urban area and becomes a channelled stream dominated with alien tree species

**Legend**

-  Urban Edge
-  Freshwater Habitat





# Flood Regulation

## Northern foothill wetlands

The wetlands north of the urban edge are large, healthy systems that provide George with scenic beauty, biodiversity, flood attenuation (for property downstream), carbon storage (due to the presence of peat), erosion control (e.g. from mountain sediments after fire), and water recharge, amongst many other services.

They need to be strictly managed and conserved for the benefit of the town. It is unfortunate that these systems become progressively degraded downstream.

## Camphersdrift River

When walking along the mountain side after a large rainfall event you will find the streams flowing strongly towards George on the foothills. However, if you look at a lower reach of the same stream within town, for example at the Camphersdrift River flowing under the road in the northern urban area, the flow might be substantially less powerful. The water doesn't vanish, but it is rather retained by the wetlands north of the town, as the gradient lessens from the mountain slopes.

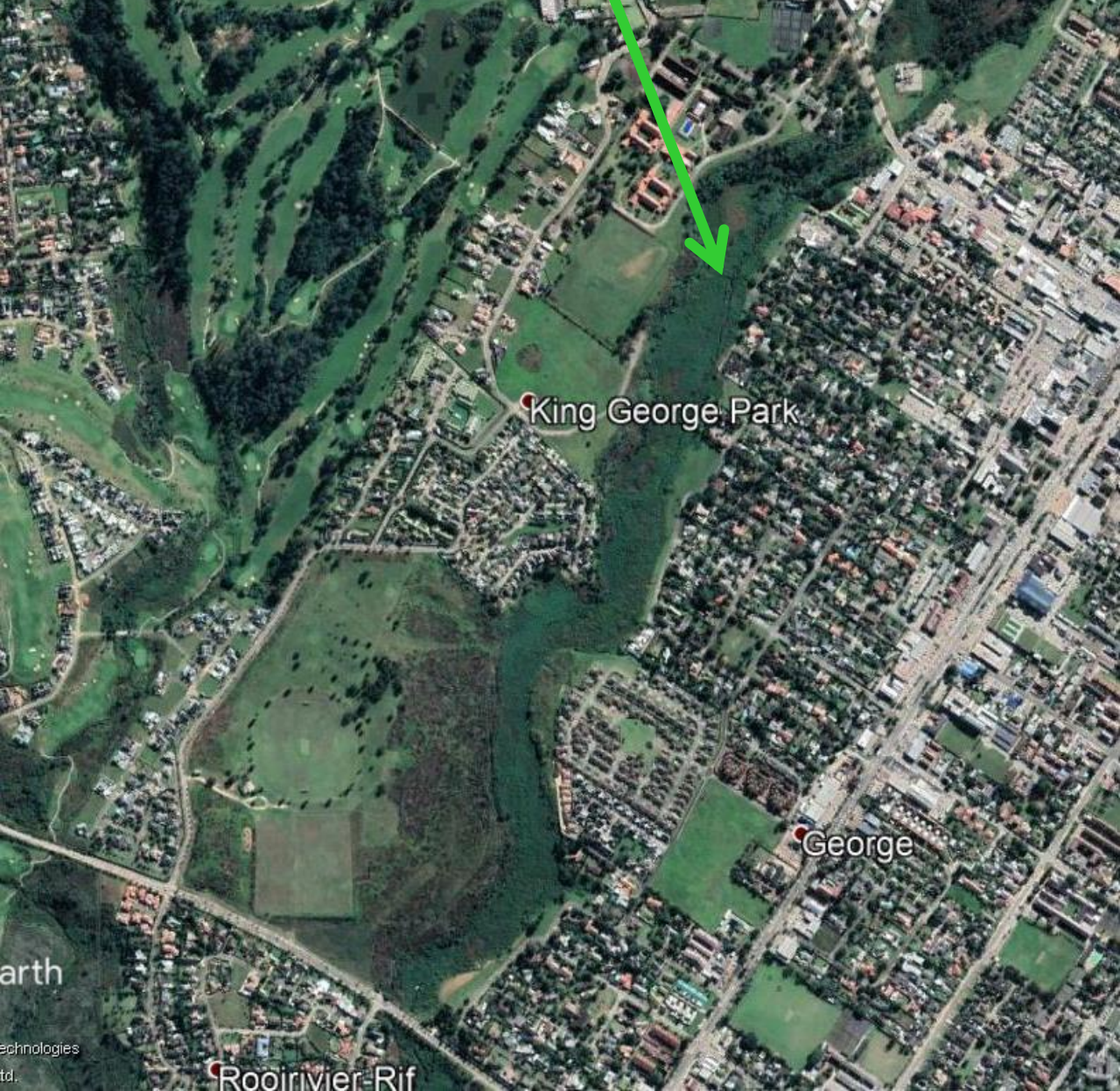
The wetlands regulate flow in this manner, and prevent flood damage in town, through retention in the soils and sustained releases maintaining flows in the entire system in low rainfall periods.

However, the river system becomes increasingly modified as it flows through the town due to past and present impacts of human activities. Canalizing a river eliminates the natural sponge effect of its floodplain and result in shorter river lengths and the loss of wetlands that serve as water retention areas.



Campher's Drift

Reach of remaining wetland habitat on the Camphersdrift River system providing regulatory services such as flood and erosion protection



King George Park

George

Rooirivier-Rif

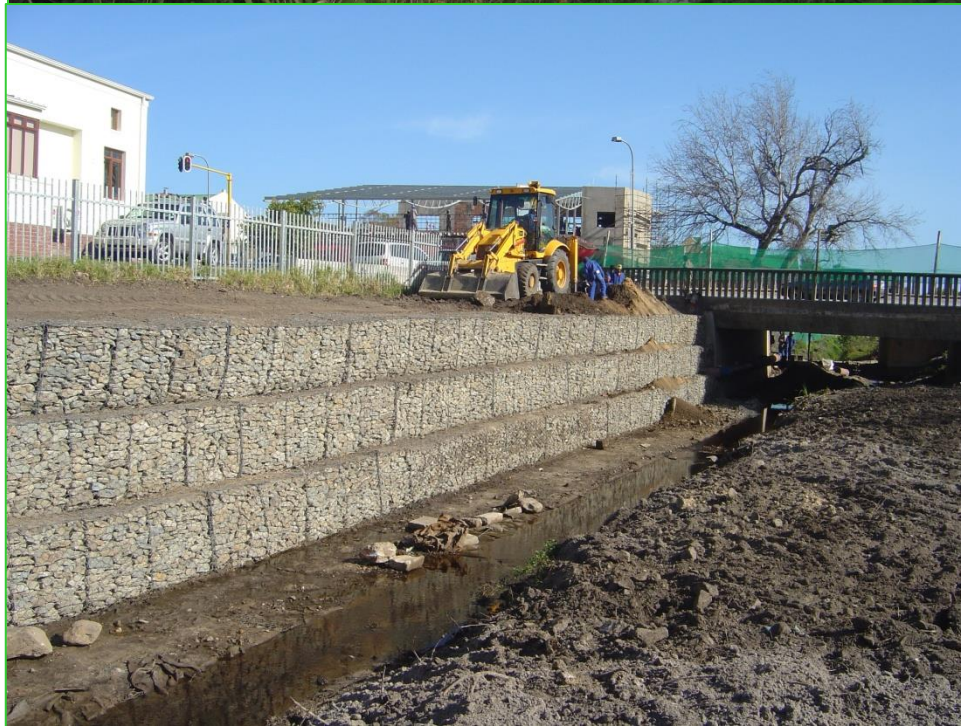
Modified and eroded reach of the Camphersdrift River resulting in an incised channel with limited lateral connectivity showing wetland loss



Camphers Drift Street culvert



Wetland habitat on the Camphersdrift River near King George Park



Encroachment of infrastructure resulting in wetland loss in town

# Rehabilitation and buffer implementation

Due to the past and present impacts of human activities the river and wetland systems of George become increasingly modified as they flow through the town. In various areas freshwater habitat has been completely destroyed or disturbed to such a degree that it can no longer function ecologically. It is evident that management efforts are currently insufficient and habitat fragmentation is increasing.

Aquatic buffer zones that are designed to act as barriers between human activities and sensitive water resources in order to protect them from adverse negative impacts must be adopted. Well-developed riparian vegetation increases the roughness of stream margins, slowing down flood flows. This may reduce flood damage in downstream areas. Aquatic buffers are therefore a cost-effective alternative to engineered structures to reduce erosion and control flooding, particularly in urban settings.

Actions/management

Remove  
aliens

Stop  
erosion

Manage  
sediments

Buffers

Engineered infrastructure

Improve stormwater  
and wastewater  
infrastructure

Maintenance

Reconnect  
floodplains

Rehabilitation  
and  
protection

# CONCLUSION

- ▶ Wetlands are the most threatened of all South Africa's ecosystems, with 62% of wetland ecosystem types Critically Endangered.
- ▶ In George, the substantial habitat loss caused by alien plants, the golf courses, and urban infill and runoff, has led to the destruction of at least 60 % of the wetlands in the urban area. The basic ecosystem functions have been destroyed and the changes are in many cases irreversible.
- ▶ Our urban wetlands and rivers must be effectively managed, and maintained in a healthy ecological condition, to benefit biodiversity conservation and society.
- ▶ Restoring rivers and wetlands as green infrastructure has the potential to decrease flooding and flood damages, and improve water quality.
- ▶ Wetlands can be further impacted by climate change but they can also act as a buffer for us against climate change. Climatic extremes such as floods will get worse and wetlands can help mitigate the impacts to society.
- ▶ Disaster risk planning and climate adaptation strategies should include the role of wetlands and the management thereof.

