water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

2030 NDP
NATIONAL DEVELOPMENT PLAN
Our Future - make it work

PRESENTATION TO THE PORTFOLIO COMMITTEE ON WATER AND SANITATION ON THE HARTBEESPOORT DAM INTEGRATED BIOLOGICAL REMEDIATION PROGRAMME

13 SEPTEMBER 2022



WATER IS LIFE - SANITATION IS DIGNITY

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- Problem Statement
- Hartebeespoort Integrated Biological Remediation Programme
- Job Creation Targets & Outcomes
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BACKGROUND (1)

- The Hartebeespoort Dam was completed in 1923 and further raised in 1969.
- The dam is mainly used for agriculture, recreation and domestic use
- Since the late 1960s, the dam has become increasingly eutrophic, due to rapid urbanization that has lead to increased runoff, erosion, sedimentation and solid waste entering the dam annually
- Some of the risk elements that impact on the dam are:
  - The discharges emanating from upstream of the dam from the 10 the municipal Wastewater Treatment Works (WWTWs)
  - Discharges from collapsing infrastructure at municipal level
  - The surrounding informal settlements from the 6 Municipalities
  - On-site wastewater treatment facilities (Package Plants)

BACKGROUND (2)

- To address the risks, in 2006 the DWS joined forces with Provincial and local Government as well as local residents to find the most sustainable short & long term solutions
- Launched Integrated Biological Remediation Programme [HDRP], also referred to as the **"HartiesMetsi a Me**"
- The main aim of the HartiesMetsi a Me project was to ensure that DWS meets its objective of achieving a desired state for the increasing trophic levels of the Hartbeespoort Dam.
- The project was paused at the end of March 2016, just before implementation of phase III
- DWS is in process reinstate the HDRP through a different institutional model to include corporate and private support.

Problem Statement (1): Upstream Catchment

- Storm water, litter and debris, erosion & sedimentation
- 720+ mega litres of purified sewage per day
- 450+ tons of phosphate per annum
- Shrinking wetlands
- Rivers – depleted riparian vegetation & in-stream habitat

Problem Statement (2): Hartbeespoort Dam

- Nutrient build up with depleting biological filters
- Dominated by exotic invasive water plants – Hyacinths, Salvinia and increased algae blooms after storm events
- Dominated by undesited & exotic fish: carp, catfish & canary kurper > 70%

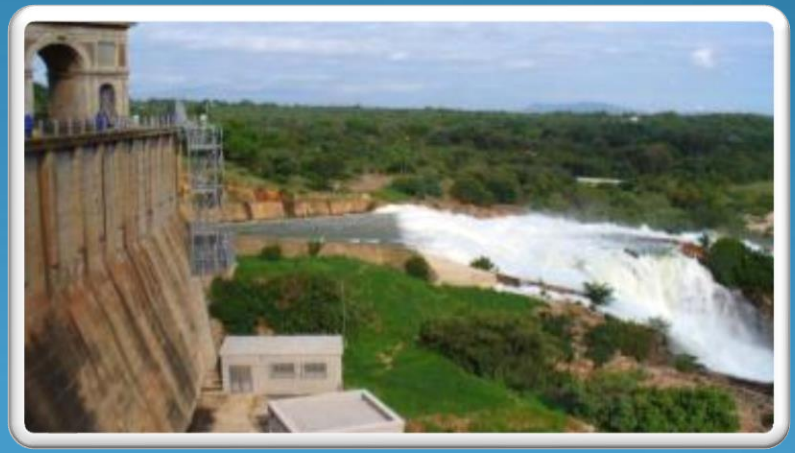
Problem Statement: Upstream Catchment

- Storm water, litter and debris, erosion & sedimentation

Residents said they were upset with the municipality's lack of response to the water problem. and a health hazard", another resident, Belinda Torr, said she stopped drinking the water. She h

Problem Statement: Upstream Catchment

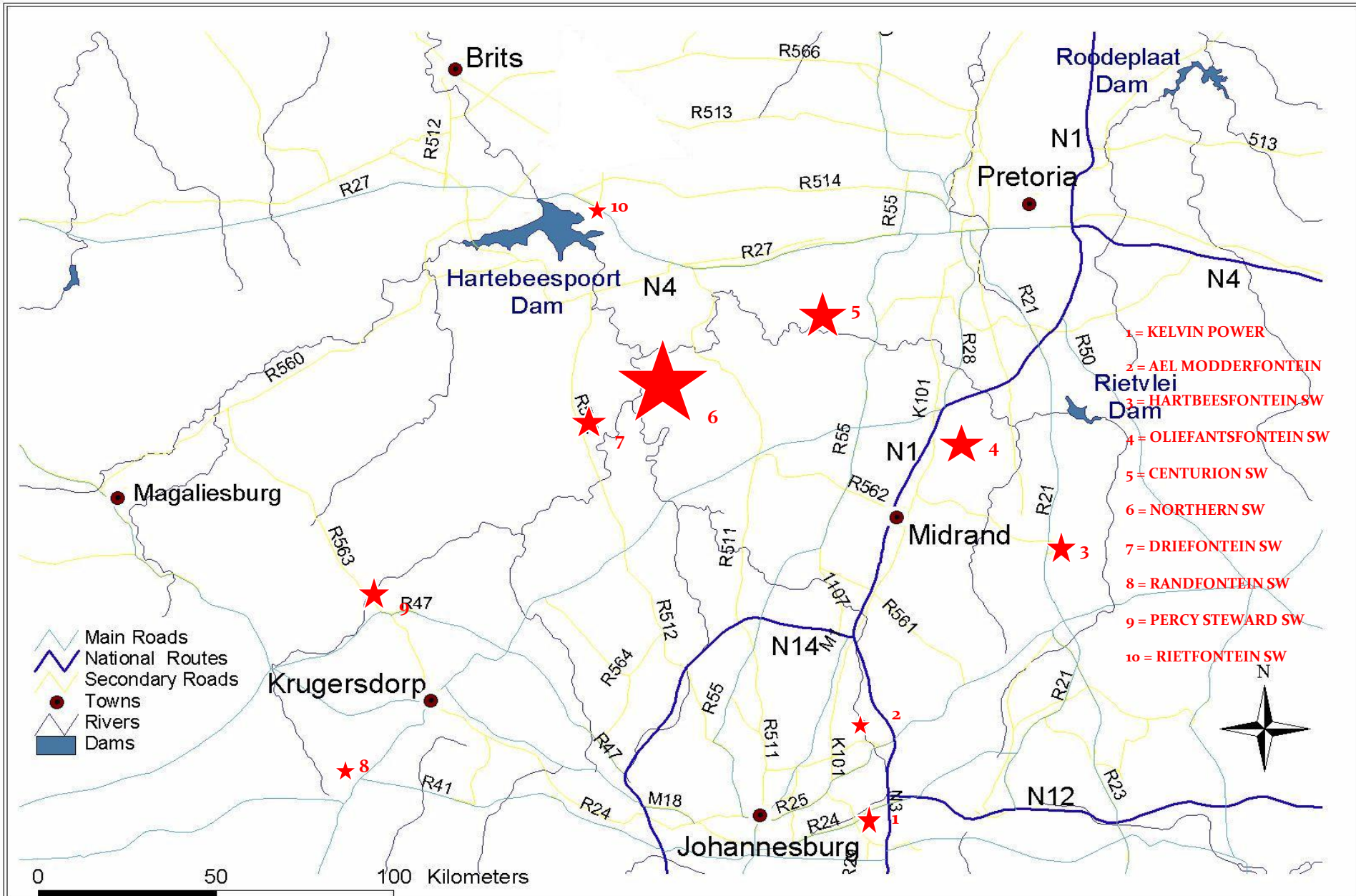
- Algae blooms (nutrient mobilisation with stormwater)



Problem Statement: Upstream Catchment

- Toxic algal blooms
- Exotic water plants - Hyacinths

Hbp dam catchment: WWTW's discharges



Hartebeespoort Integrated Biological Remediation Programme

Biological Remediation conceptualisation	2001
Development of remediation plan	2003 – 2005
2 Main reports	
• Action plan (volumes 1 & 2)	2004
• Fish community study HBPD	2005
Publish plan – NW: Env Man Series 5	2005
DWA appoint RW implementing agent	2006
DG DWA instruct fast tracking	2007
Programme inception:	2007 – 2008
1st Phase BP dev. & implementation	2007–2012
2nd & 3rd Phase BP dev. & Implementation: (Full scale implementation & extension to other dams)	2012 - 2016

Overall objectives to achieve sustainability

- **Implement IWRM principles in catchment to enhance:** Growth, Development and Work creation
- **Determine, optimise & manage physical and biological conditions in dams and catchment to ensure optimal diversity through more efficient nutrient balance to ensure reduction of:**
  - Reduce Eutrophication (Algae blooms) & Nutrient load
  - Exotic and invasive species (Hyacinth and alien vegetation)
  - Reduce opportunistic sediment feeding fish population

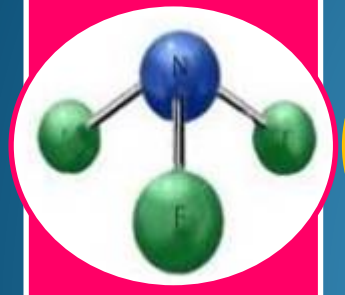
Conserve, manage and remediate …

- **Shoreline and establish artificial Floating Wetlands**
- **Wetlands, river banks and in-stream habitats in the catchment**

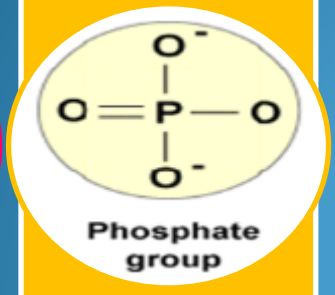
Main objectives (HDRP test case)

- **Physical measures (dam basin)**
  - Biomass removal (algae and hyacinths), surface and bottom
  - Litter and debris
- **Biological Measures (dam basin)**
  - Biomass Establishment (shoreline = riparian & in-stream)
    - Floating Wetlands
    - Food web restructuring (fish harvesting)
- **Nutrient load reduction: (catchment)**
  - **Sediment management (internal & external)**
  - **Target PO_4 in catchment**
    - **Reduction at source – urine diversion & detergents**
    - Direct re-use of treated sewage effluent
    - Resource protection, land management, compliance & enforcement (Integrated Water Use Licenses)

Diversity function as nutrient trap / filtration



Excessively enriched by the nutrient (phosphate, nitrogen, potassium, carbon, etc.)



Vegetation and Algae growth not only limited by nutrient levels, but also physical & biological conditions

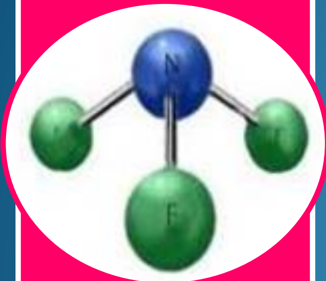
Physical

Hydrology (flooding), wind, turbidity, solar radiation, temperature, etc.

Biological

Diversity, literal zone vegetation, zooplankton, fish, etc. (foodweb)

Absence of diversity – ultimately results in hypertrophic water resources



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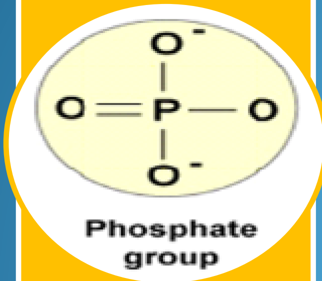
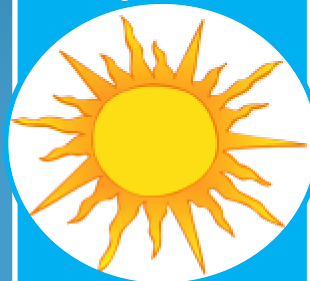


Vegetation and Algae growth not only limited by nutrient levels, but also physical & biological conditions

Physical



Hydrology (flooding), wind, turbidity, solar radiation, temperature, etc.

Biological

Diversity, literal zone vegetation, zooplankt... (f...)

Boom at the Westlake Bridge: 850m

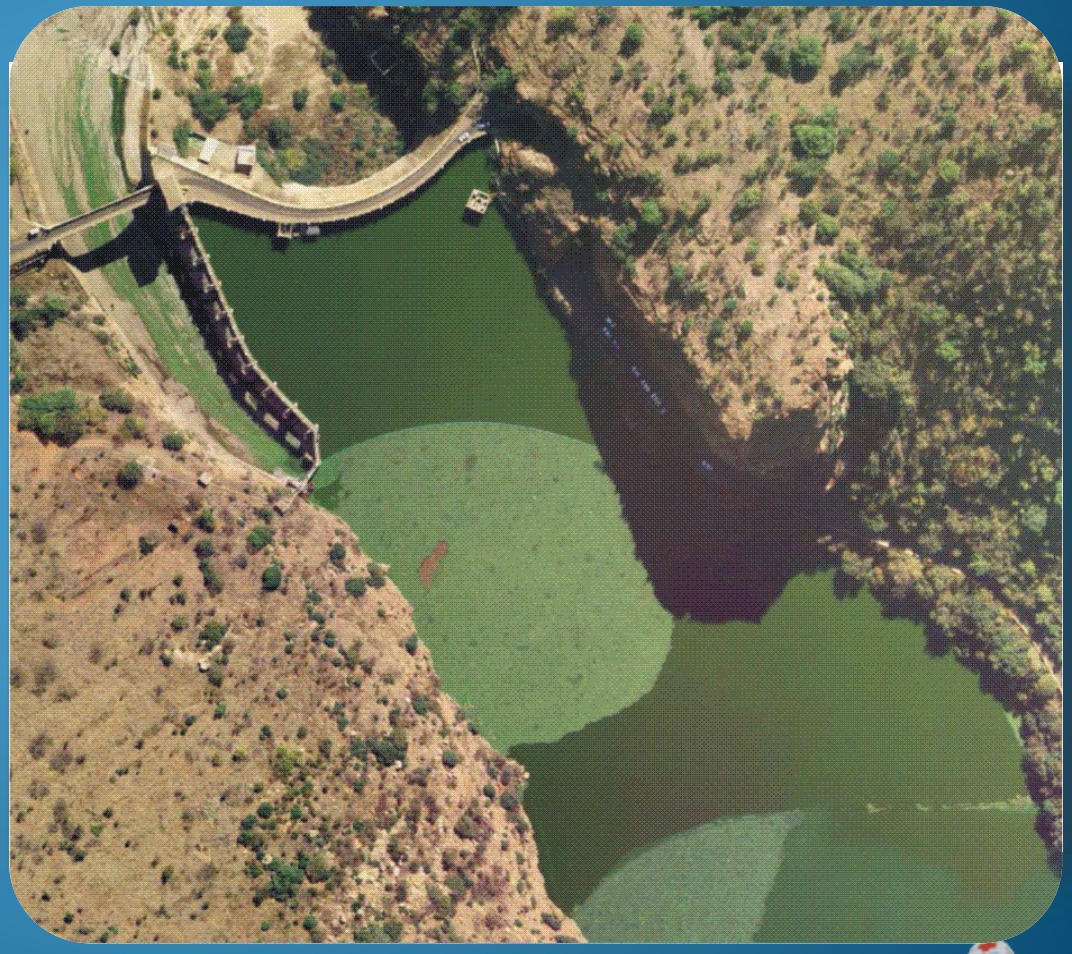
Algae and debris containment boom Dam Wall

Working for Water teams removing Hyacinths

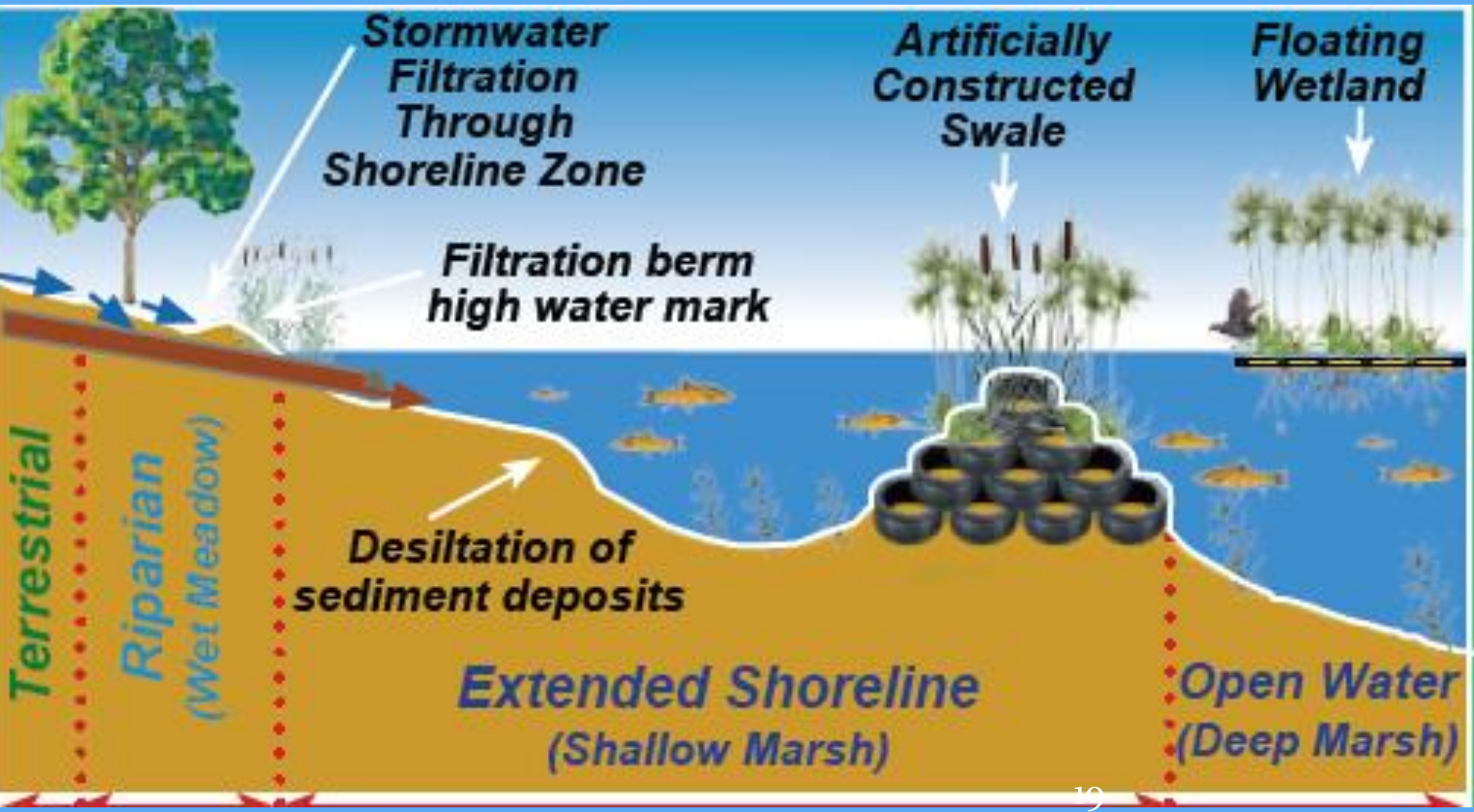
Biomass Removal

- **Prioritised areas**
- Dam wall - 1
- Crocodile River Inlet - 2
- Magalies River – 3
- Leeuwenspruit inlet- 4

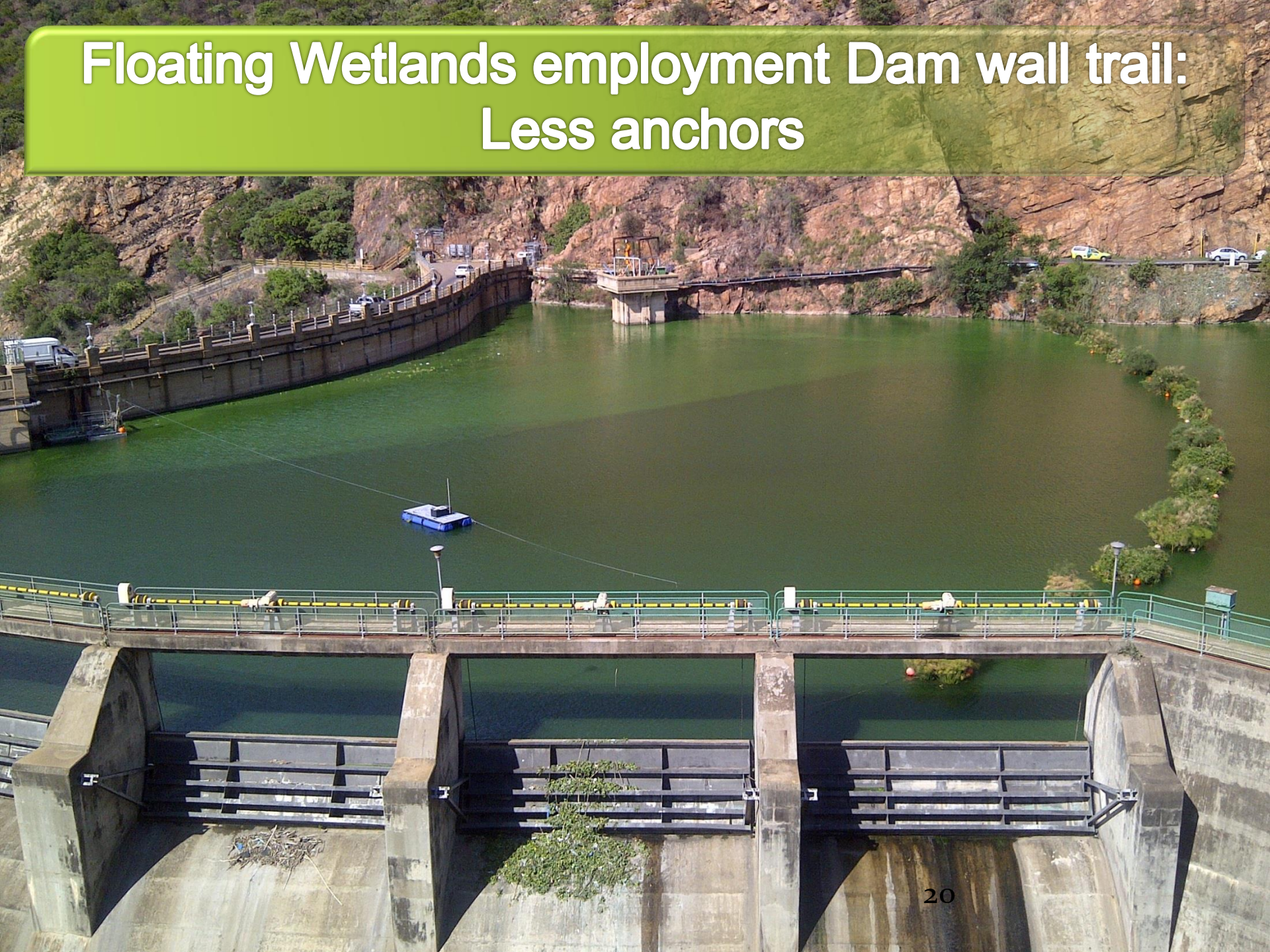
- **Removal of**
- Algae & hyacinth
- Debris & litter



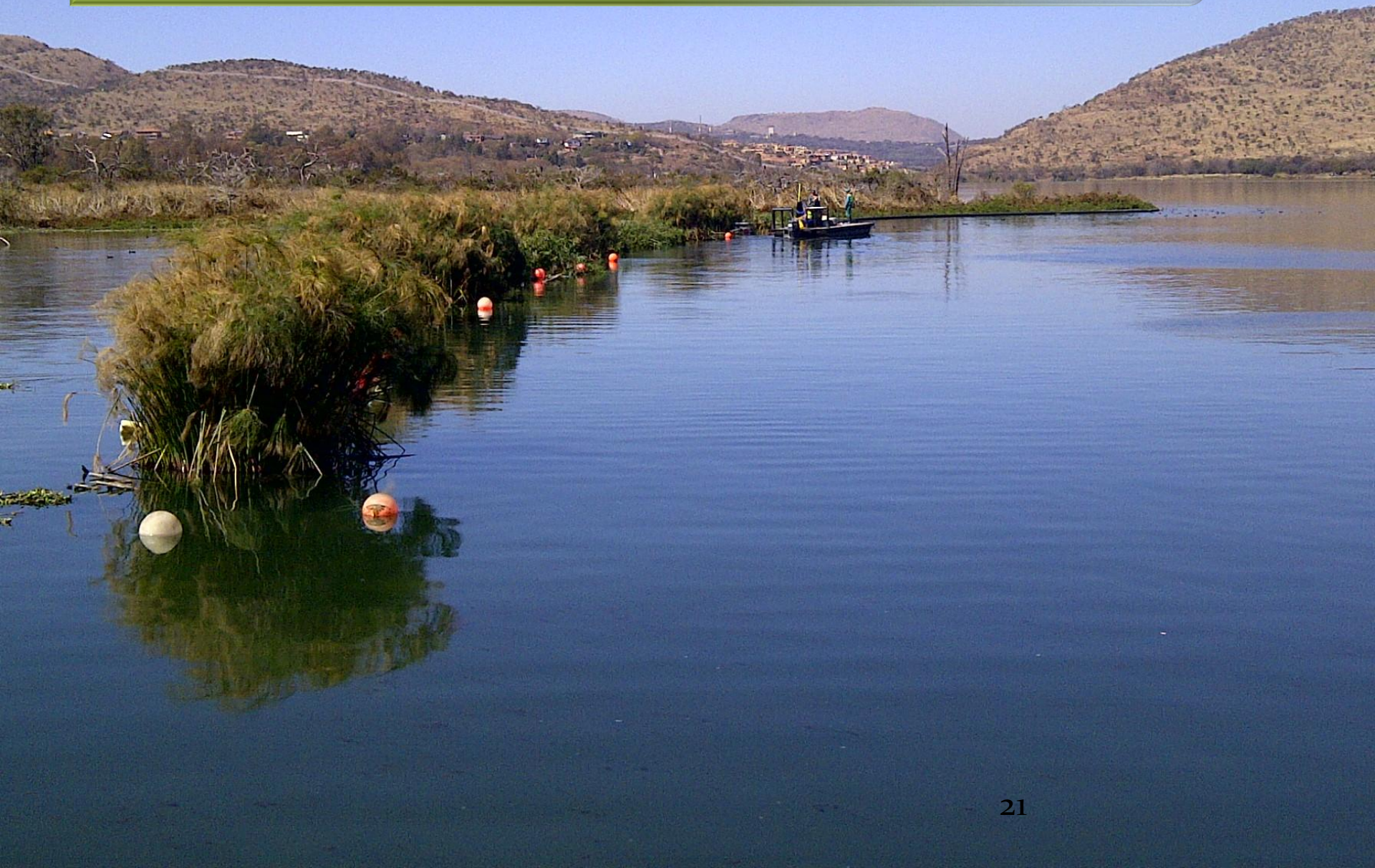
Establishing shoreline vegetation



Floating Wetlands employment Dam wall trail: Less anchors



Floating wetland at Ifafi 2013



Desired / undesired fish species

Oreochromis mossa

(Mozambique Tila

ilander

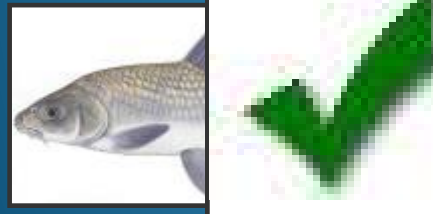
oder)

Micropterus salm

(Largemouth Ba

osus

b)



Labeobarbus polylepis (Smallscale

Yellowfish)

Barbus trimaculatus (Threespot Barb)

350 tons p/a is
Equal to R12 million p/a

Barbus mattozi (Papermouth)

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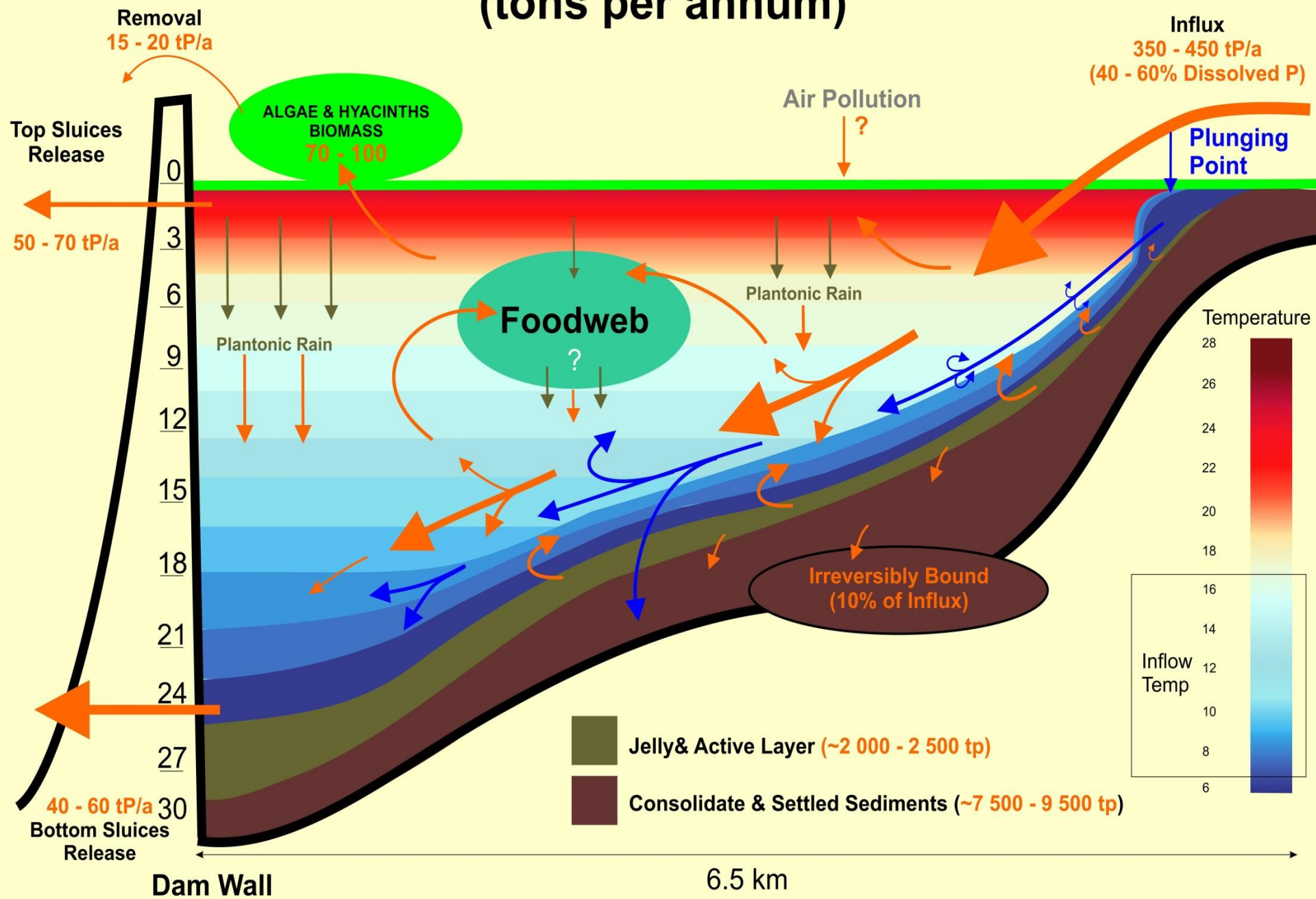
Harties, metsi a me
Integrated Biological Remediation Programme

RAND WATER

Hartbeespoort Dam Total Phosphate (TP) Distribution (tons per annum)



Sediment Zones

The Excavation of the Flood Zone (Roos se Oord)

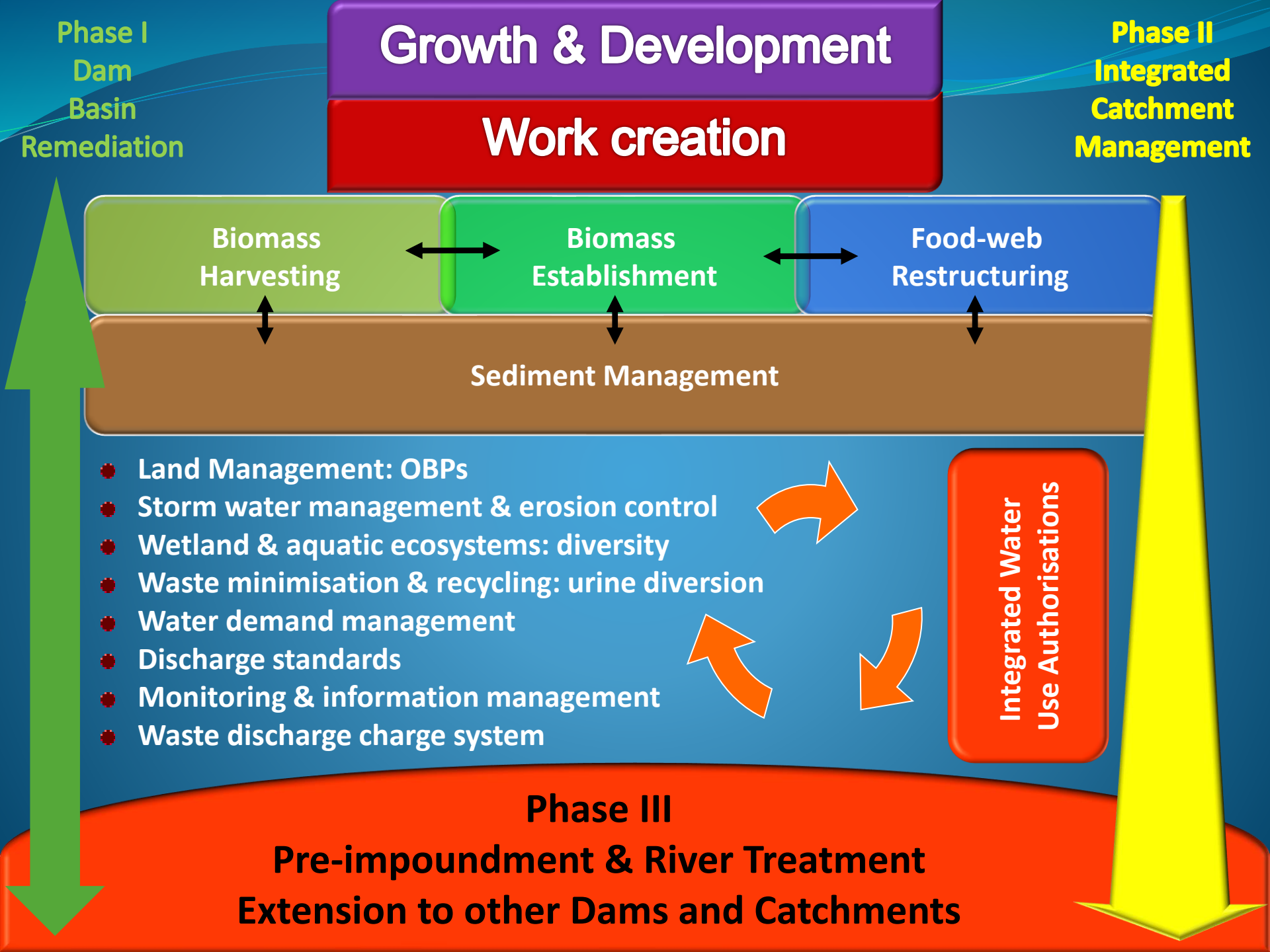
Sediments in flood zone before the excavation

Bulk Sampling: Jelly layer at Dam Wall

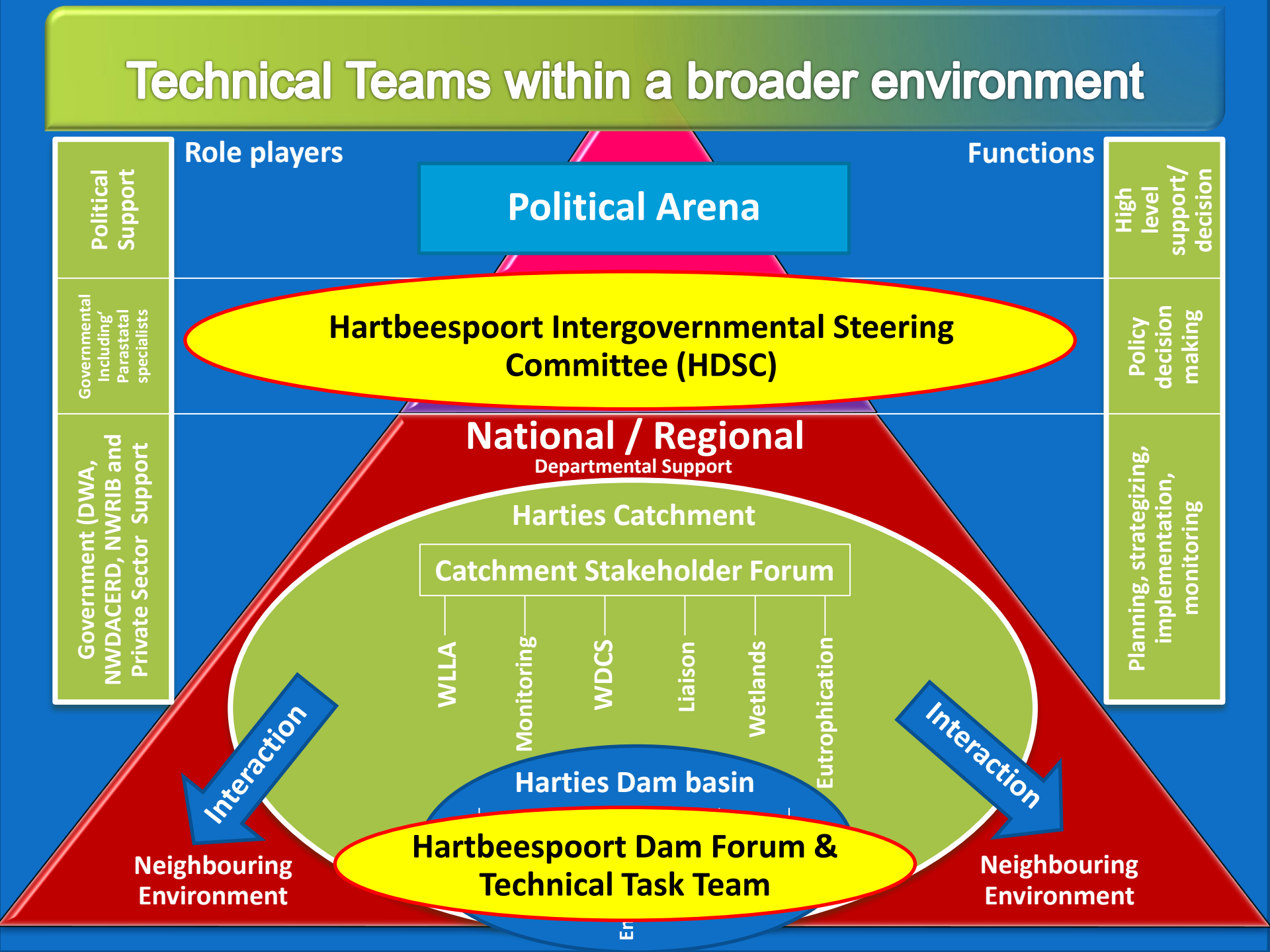
Bulk Sampling: Jelly layer at Dam Wall

3 Year Budgeting Scenarios (excl. VAT)

Scenario I **O&M** X1000	**R33 880**	**R37 268**	**R40 995**
Scenario II **Fast Tracking** (O&M +) X1000	**R67 385**	**R74 123**	**R81 535**
Scenario III **Full Scale + Extension** (Fast Tracking +) X1000	**R 228 579**	**R115 336**	**R 110 570**


Phase I
Dam
Basin
Remediation
Growth & Development
Work creation
Phase II
Integrated
Catchment
Management
Biomass
Harvesting
Biomass
Establishment
Food-web
Restructuring
Sediment Management
Land Management: OBPs
Storm water management & erosion control
Wetland & aquatic ecosystems: diversity
Waste minimisation & recycling: urine diversion
Water demand management
Discharge standards
Monitoring & information management
Waste discharge charge system
Integrated Water
Use Authorisations
Phase III
Pre-impoundment & River Treatment
Extension to other Dams and Catchments

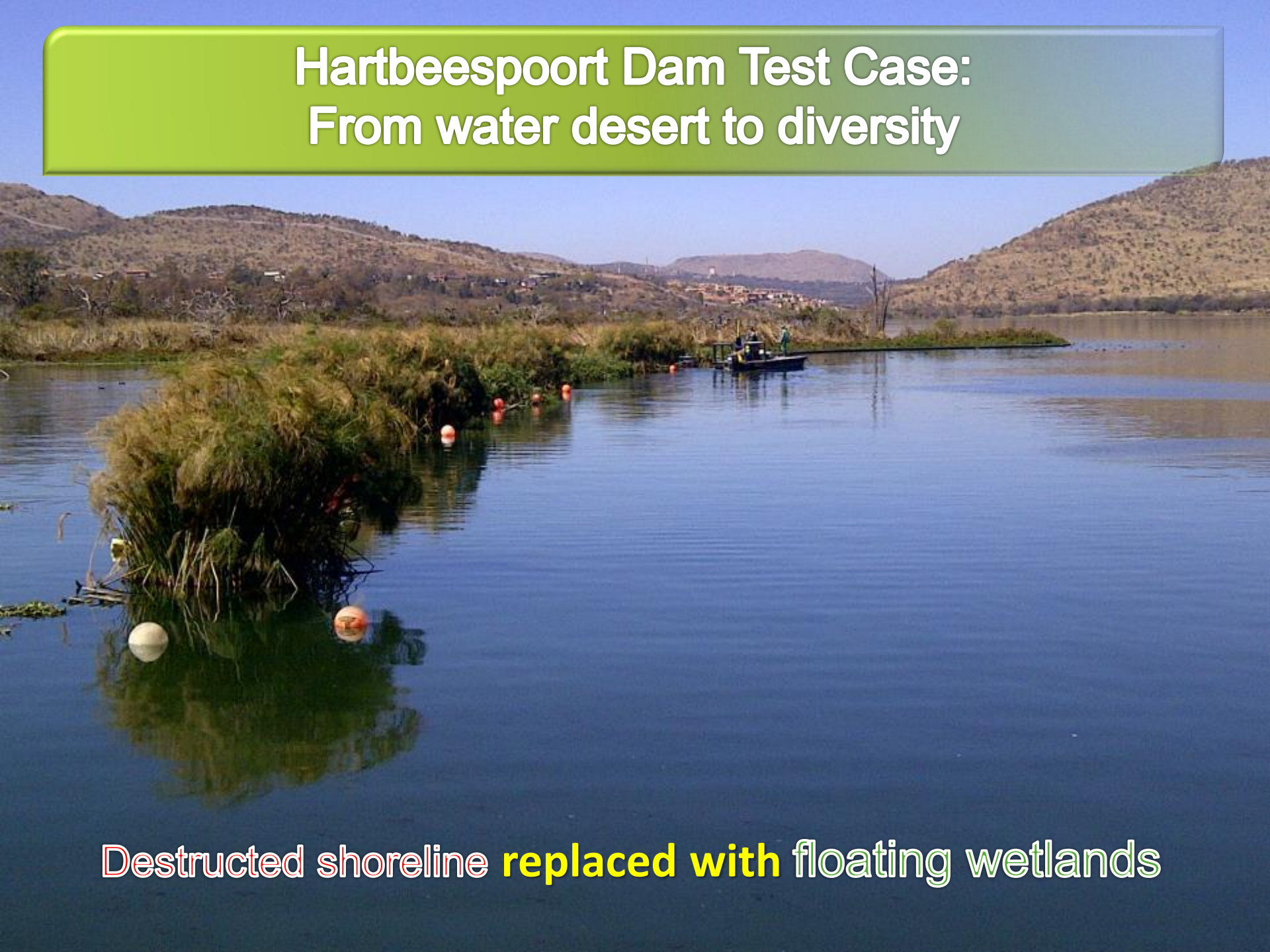
Technical Teams within a broader environment



Summary of Remediation Plan
Main issues identified & interventions

1) Water quality management - point and non-point sources **– Land Management Practices, Enforcement & WDCS**
2) Fisheries management **- Foodweb restructuring & diversity**
3) Balance reservoir ecosystems **- Shoreline & Floating Wetlands**
4) Recreational Activity Control & Boating regulations **– Resource Management Plan (RMP)**
5) Recreational access opportunities **– Local Rules**
6) Ecologically valuable areas & land management **- RMP**
7) On-going monitoring **– Integrated monitoring program**
8) Intergovernmental liaison **– HDSC / Inter Gov. Forum**
9) Public awareness & education programs **– Communication Centre (ICC)**

Hartbeespoort Dam Test Case: From water desert to diversity



Destructed shoreline **replaced with** floating wetlands

Hartbeespoort Dam Test Case: From water desert to diversity

Increased numbers of Red Knobbed Coot

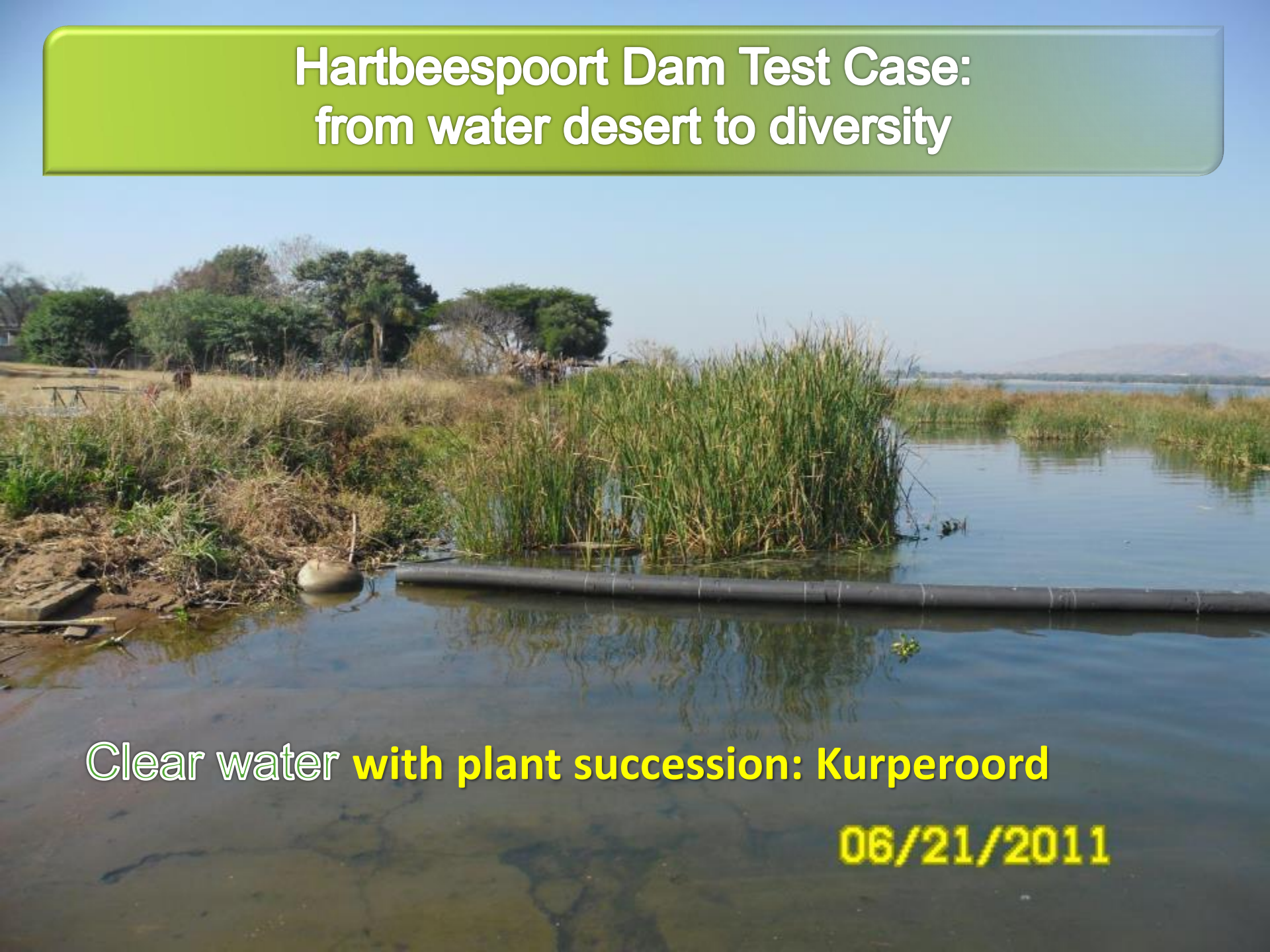
Hartbeespoort Dam Test Case: From water desert to diversity

Algae contained by boom

Curled-leaved pondweed

Strands of filamentous algae with fennel-leaved pondweed

Hartbeespoort Dam Test Case: from water desert to diversity



Collective outcome of Hartbeespoort dam Integrated Biological remediation programme: Overall biodiversity increase

Small Fish

Birds

Crab

Invertebrates

Water Grass (Curly-leaved pondweed)

Job Creation Targets and Outcomes

Persons employed		Outcomes	Targets
Fisheries SMME		12	33
Shoreline & Floating Wetlands		23	35
Algae, Hyacinth, Litter & Debris Removal & Treatment		65	90
Vermiculture composting		5	10
Temporary	Hartbeespoort dam	20 - 30	30
(2008/9)	Roodeplaat dam	90	30
(2010/12)	Community Works Program	80 - 200	300
Aquaculture & River Rangers		0	10
Information Communication Centre & Admin		5	8
Sediment Removal & Management		0	>15
Total (excluding positive spinoffs for local economy)		110	560+

Expected Climate Change: Possible Ecosystem adaptations and Disaster Risk Reduction

- Holistic approach to Conserve Water and Safe the Environment => **"Big Five"**
- Extend conservation of diversity to extensive remediation of depleted and distorted land and environment. Improved Diversity -> Increase Biological resilience
- Improved land management practices (IWRM) to incorporate anti-Desertification principals for Agriculture, Urbanisation, Mining and Industry

Thank You