SHARED WATER

Addressing Water Risk in Agricultural Catchments using the Water Balance Tool

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About Us

- NGO and registered Public Benefit Organisation
- Independent science for freshwater conservation
- Turning data into practical water-management decisions
- Bridging research, policy, and on-the-ground action

Proven Impact

- High scientific credibility and specialist expertise
- Building long-term capacity in aquatic science

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Conserve - Explore - Experience

CONTEXT

GLOBAL FRESHWATER

SOURCE-2-SEA

Water is the thread that connects people, communities and ecosystems along the Source-to-Sea continuum

Actions upstream shape downstream outcomes—and downstream conditions influence upstream decisions

We can easily withdraw water faster than nature replaces it

CONTEXT

GLOBAL WATER RISK

Sacramento & San Joaquin Valley California

- 1960s → 1990s through the 2010s → surge in permanent crops
- **Severe Drought 2012–2016**
  - Reduced river flows
  - Reduced reservoir storage
  - Increased reliance on groundwater

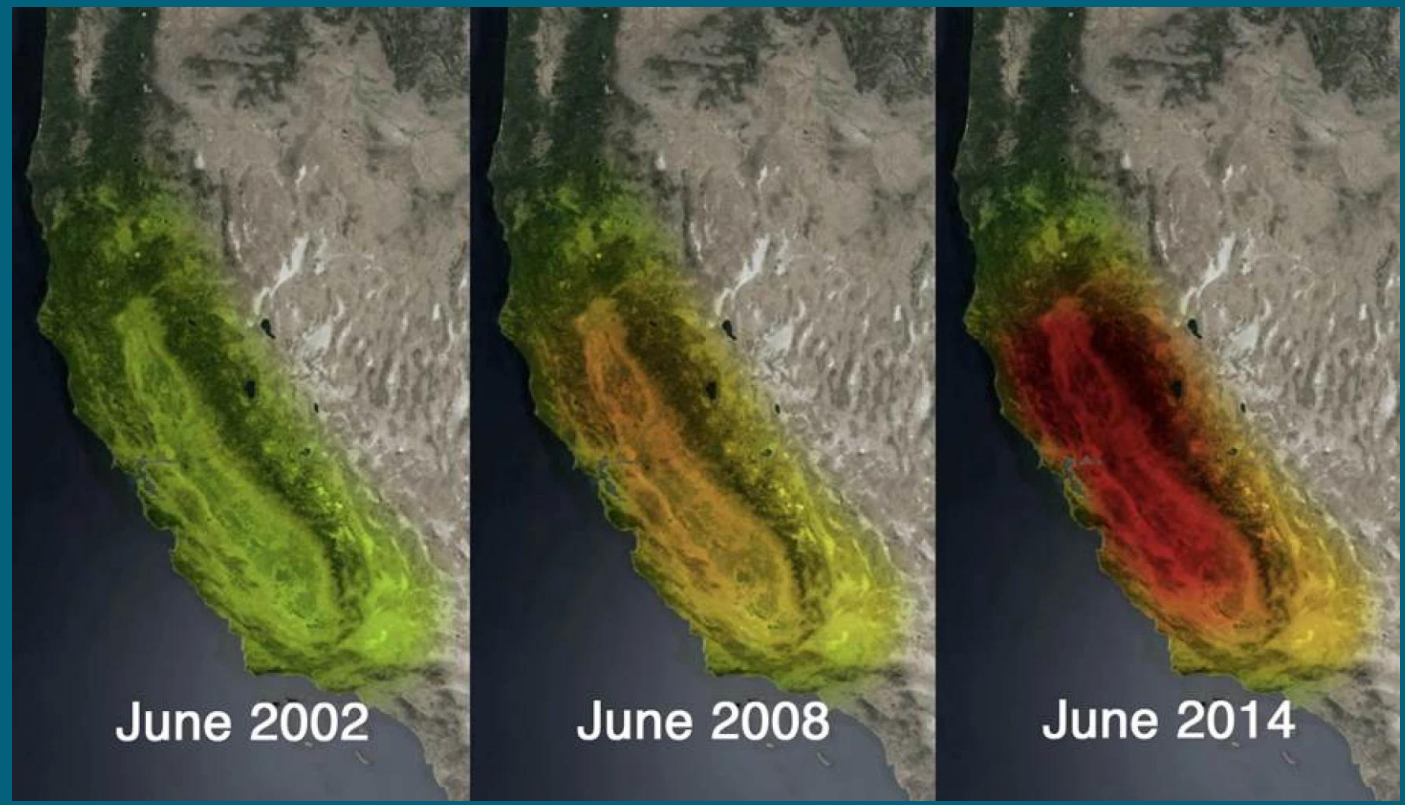
CONTEXT

GLOBAL WATER RISK

Sacramento & San Joaquin Valley California

Groundwater abstraction exceeded recharge by several km³

- Ground subsidence – 60 cm/year
- Damage to infrastructure
- Fallowing of 170,000–220,000 hectares
- Economic losses and thousands of seasonal jobs lost



Groundwater depletion across California's Central Valley detected by gravity changes caused by declining underground water storage (NASA's GRACE Mission)

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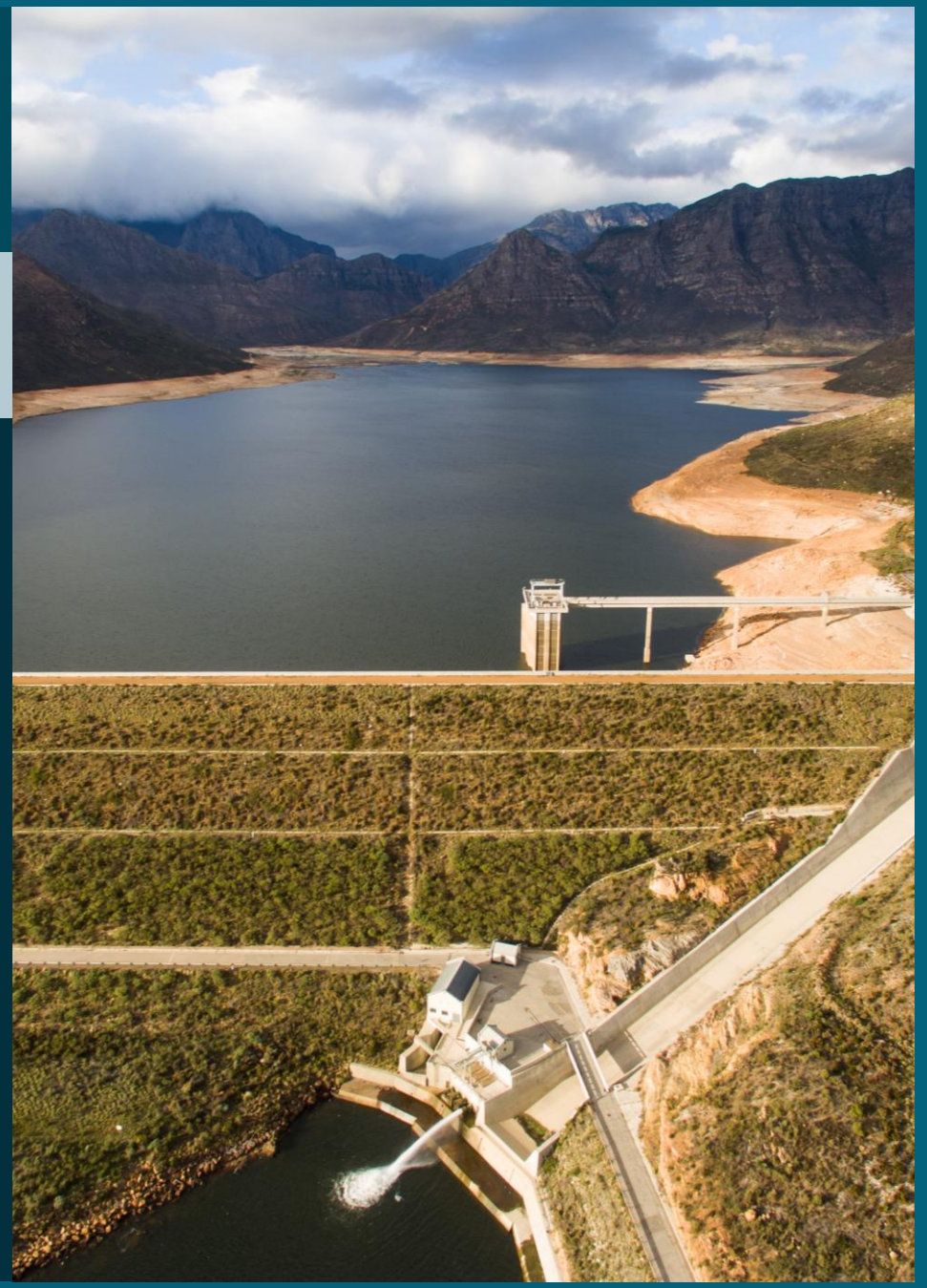
CONTEXT

THE CONTEXT

SOUTH AFRICA'S WATER REALITY

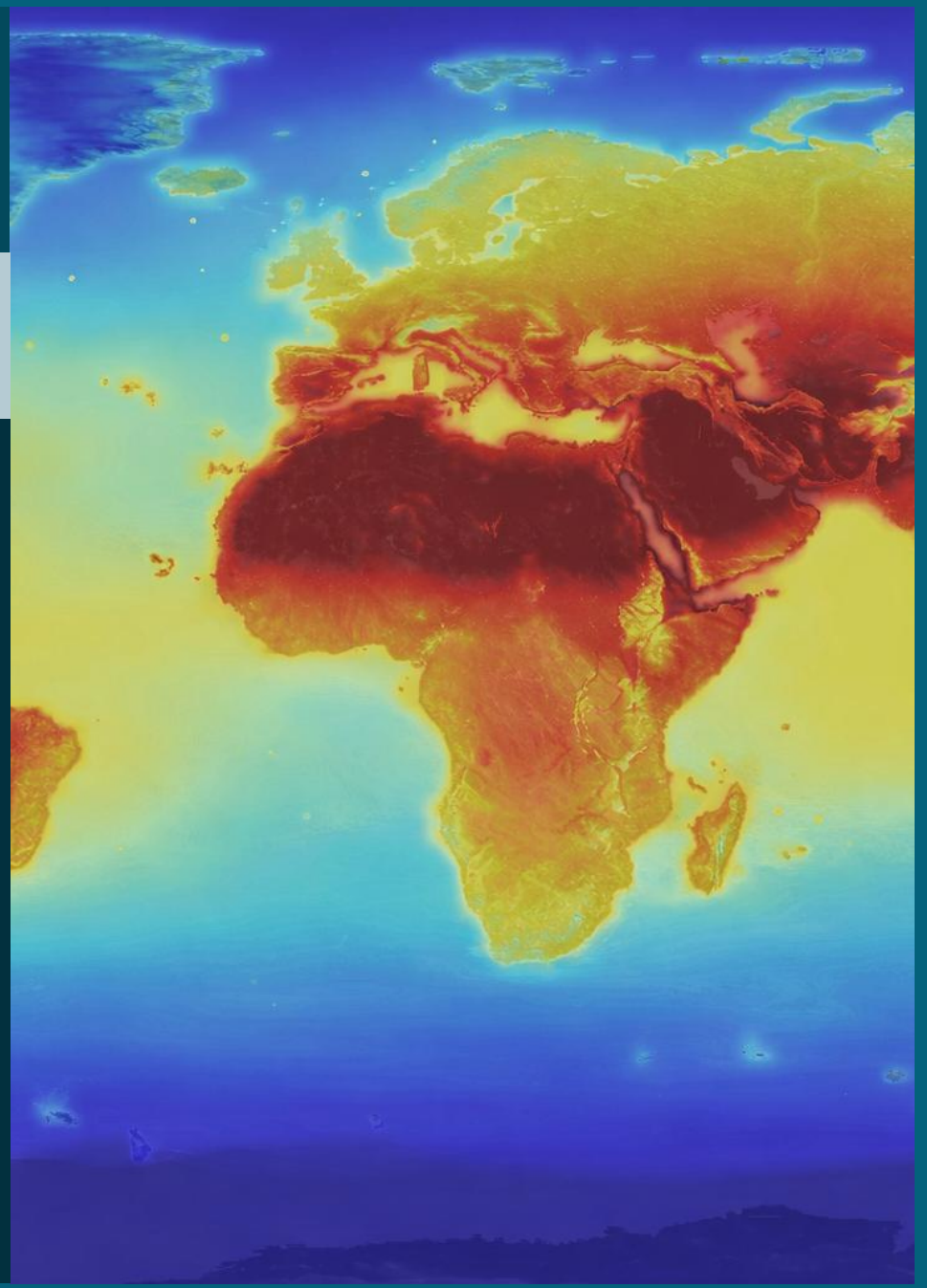
- Water is the Western Cape's binding agricultural constraint → almost no slack
- WCWSS is treated as over-allocated,
- Limited headroom for quick "new water" solutions
- Agriculture holds ~90% of allocations in Breede, Gouritz, Olifants catchment areas



THE CONTEXT

WRITING ON THE WALL

- **2015–2017 record-breaking temperatures** — Cape Town 42.4°C (3 Mar 2015), 42.1 °C (11 Mar 2026),
- **Number of very hot days** (>35°C) doubled
- Cape Town's **long-range planning** assumes a 25% reduction in yield by 2045



THE CONTEXT

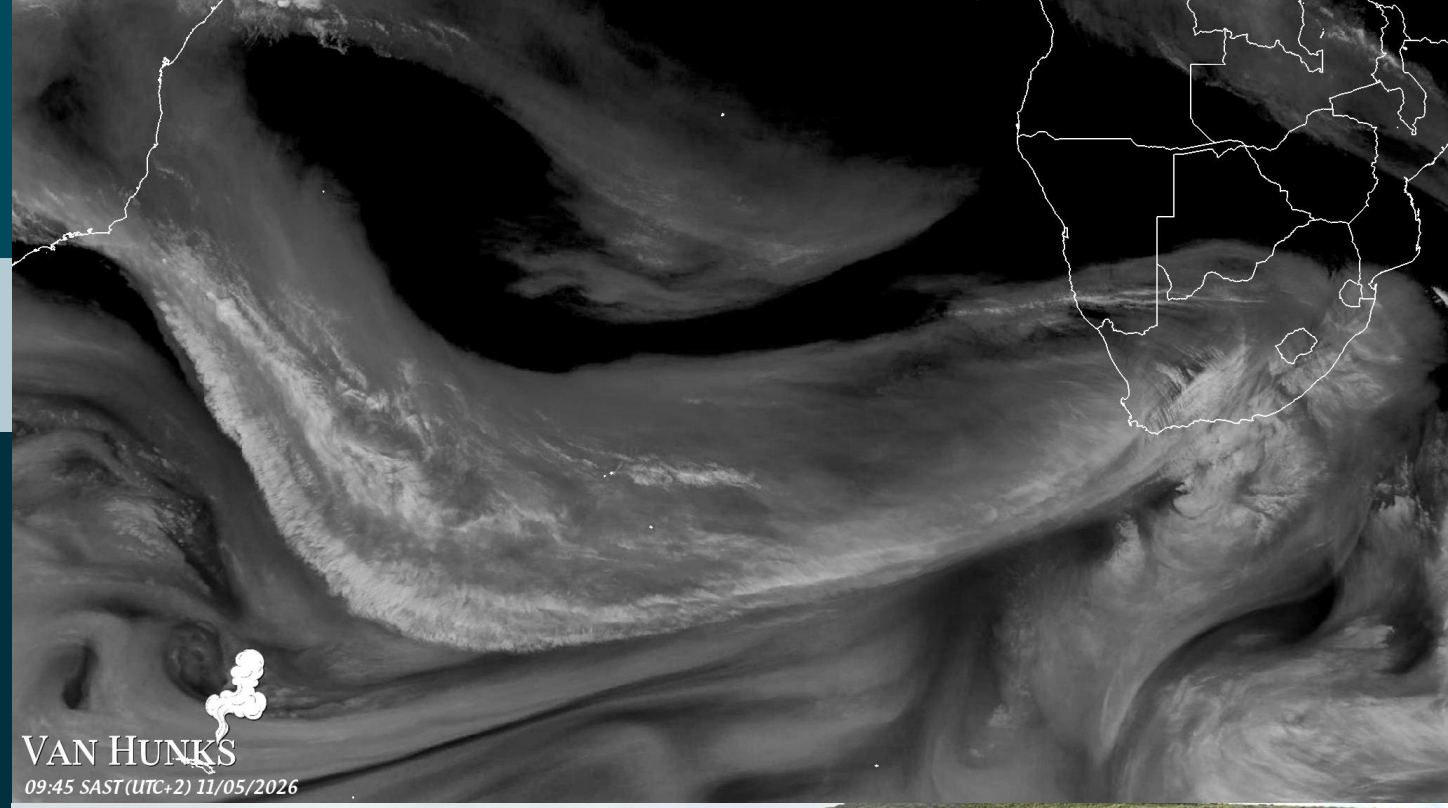
WRITING ON THE WALL

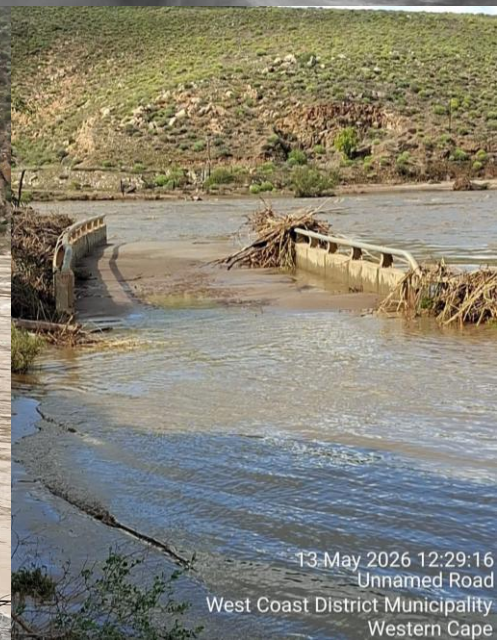
May 2026: Multiple frontal systems

200-300 mm in 48 hours—117 km/hr winds (119=hurricane)

Moisture plume “atmospheric river” extends ~6,000 km from Brazil to the Cape.

Rainfall events less frequent → more intense





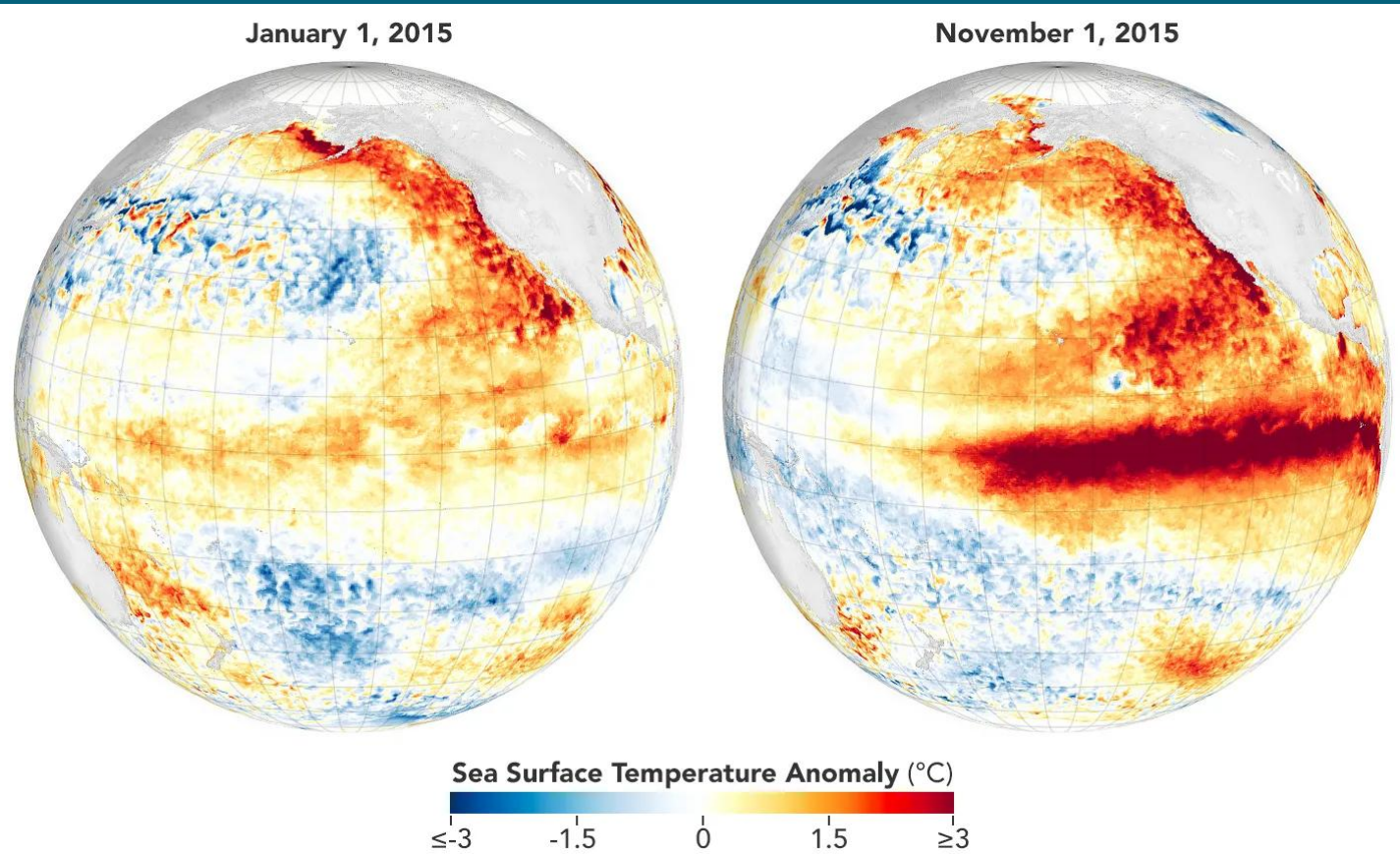
THE CONTEXT

WRITING ON THE WALL

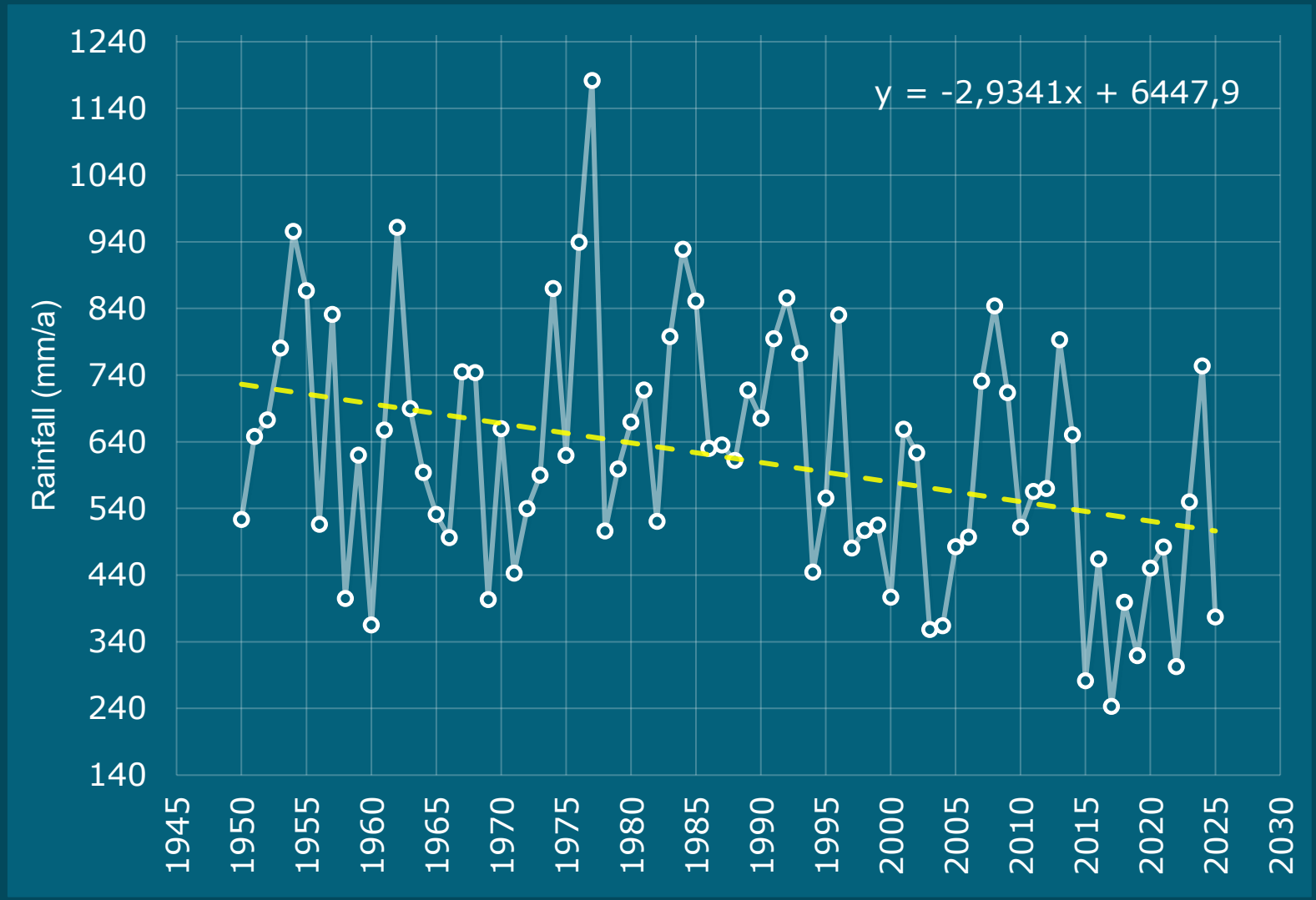
El Niño event expected to peak in late 2026 and persist into early 2027

Subsurface temperature readings at depths of 50 to 150 meters in the eastern Pacific show anomalies up to 6°C above normal

The "Super" Threshold: exceeding 1982/83, 1997/98 and 2015/16 El-Nino's



Koue Bokkeveld: 1950-2025



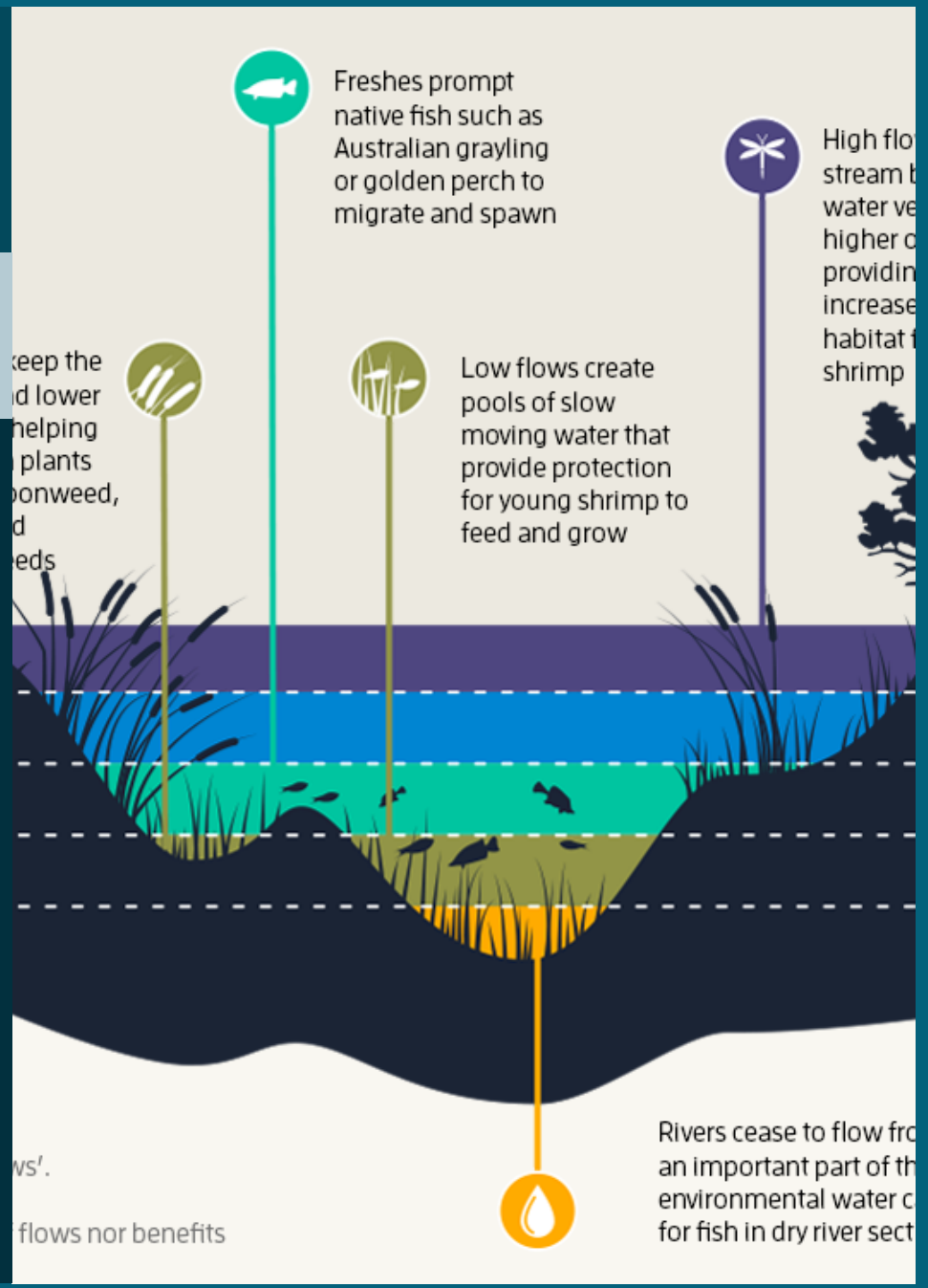
Decadal mean annual rainfall declined from 682 mm/year in the 1950s to 434 mm/year in 2016–2025 (36%)

CONTEXT

WATER FOR THE ENVIRONMENT

THE ECOLOGICAL RESERVE

- Under the **National Water Act**, the **Ecological Reserve** has priority over all other uses
- It protects basic human needs, the needs of all users (municipal, industrial agricultural) as well as river ecosystem functioning
- Water may only be allocated to agriculture after the Reserve is secured
- **CHALLENGE**: how to manage agricultural water use within these limits

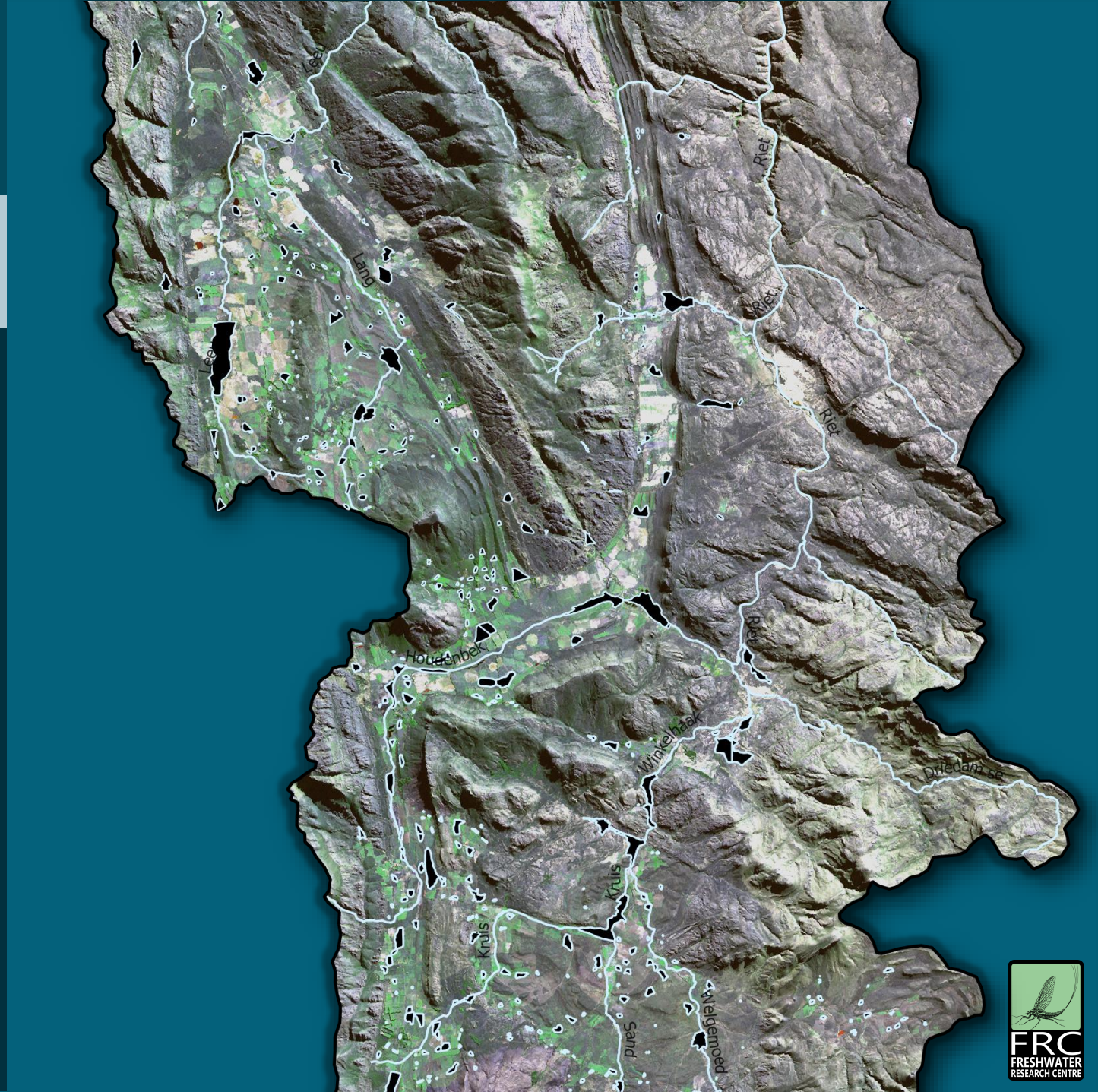


THE CONTEXT

WATER RESOURCES MANAGEMENT

CHALLENGES

- Privately owned farm dams constrain shared management
- Limited national hydrological capacity
- Loss of gauging weirs > degraded monitoring networks > weakened confidence in water balances
- WULs issued based on very little local knowledge of catchments



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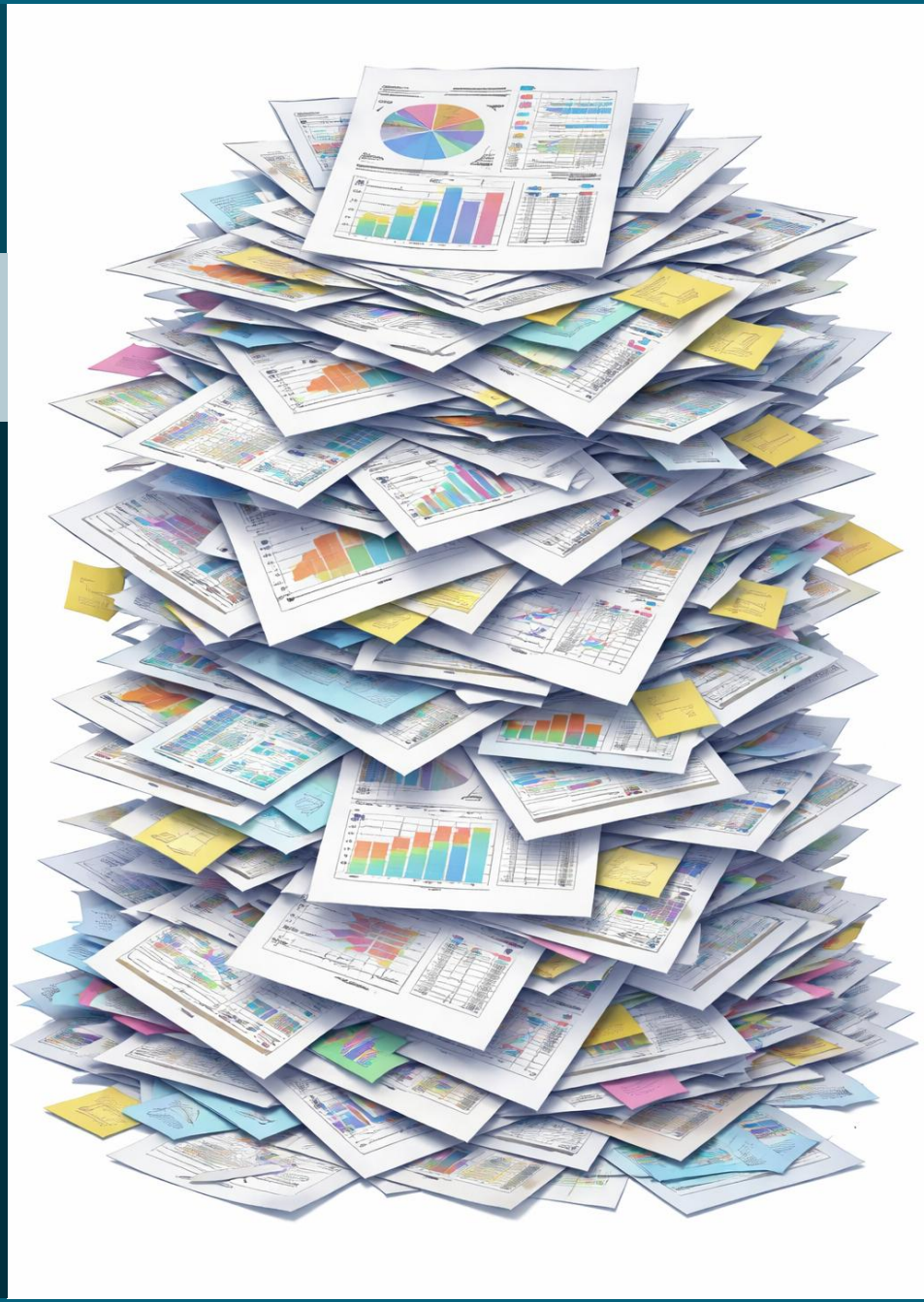
ECOLOGICAL RESERVE

“INFORMATION OVERWHELM”

- Reserve determinations arrive as large consultant reports: technical, dense, time-consuming to digest
- Key outputs are buried in appendices, spreadsheets and assumptions that are hard to audit
- Formats differ across catchments and consultants, making comparison and reuse difficult
- Departments need operational outputs for WUL decisions



CONTEXT

WATER RESOURCES MANAGEMENT

SOUTH AFRICA

The key constraint in South African water resource management is capacity at catchment level — not the availability of sophisticated planning platforms

WATER BALANCE TOOL

PURPOSE

Bridges the gap between basin-scale hydrological modelling and day-to-day water management decisions at the local catchment scale

Places practical water accounting directly in the hands of Water Users.

WATER BALANCE TOOL

Assist landowners collectively navigate increasing variability with better information

WATER RECOURCES MANAGEMENT

WHERE DOES IT FIT IN?

Pitman: (SA)

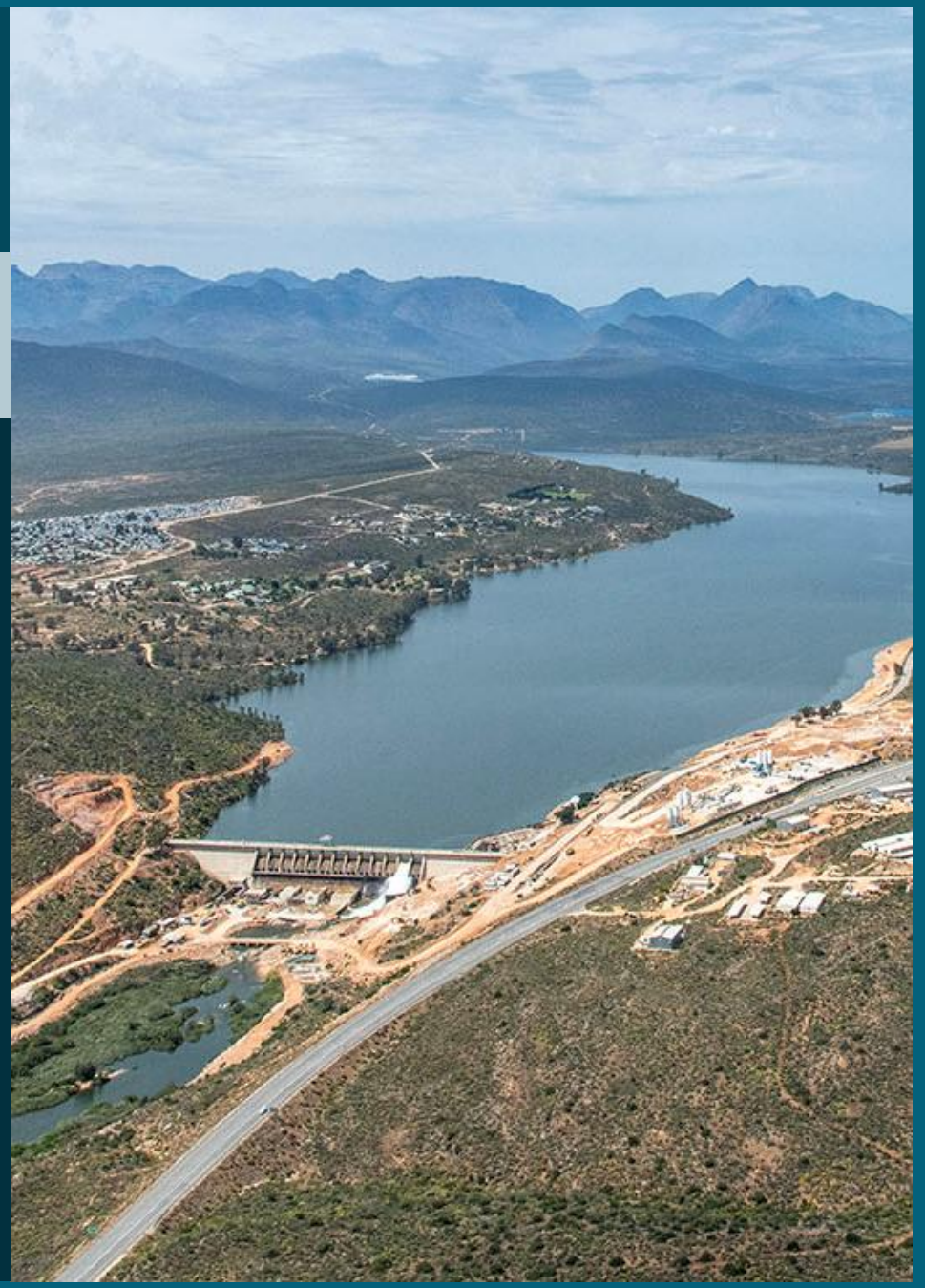
Foundational hydrological simulation model, but more of a specialist hydrological engine than a locally embedded operational governance tool

ACRU: (SA)

Strong agro-hydrological and land-use model, but more specialist-dependent and less oriented to transparent day-to-day water sharing by WUAs

WEAP: (Sweden/US)

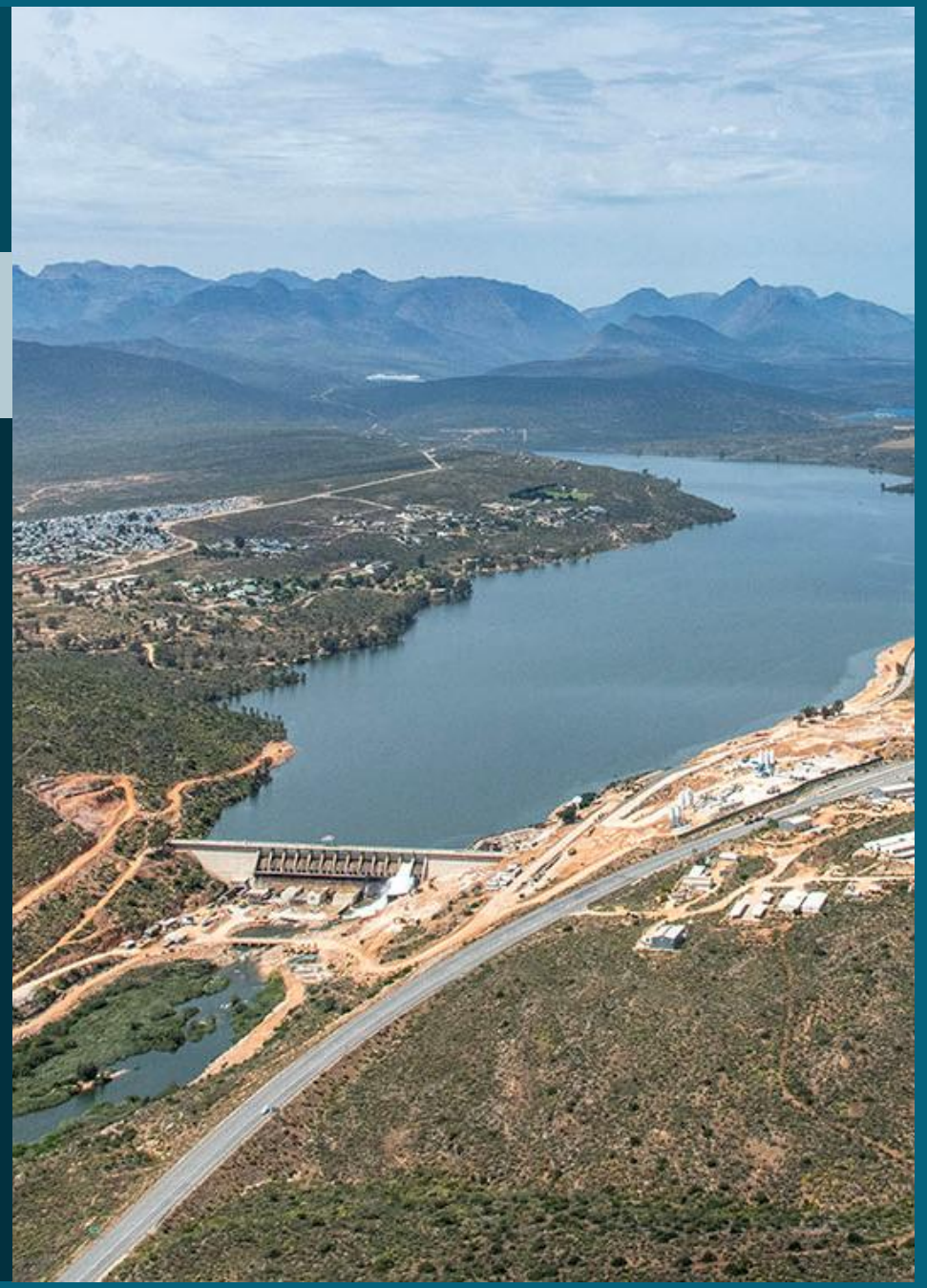
more of a planning model than a locally embedded operational governance tool



WATER BALANCE TOOL

WHERE DOES IT FIT IN?

- **Water Resources Planning Model (WRPM) / Water Resources Yield Model**
  - Designed for large-system yield and planning analysis
  - Strong in stochastic risk and assurance assessment
  - Used by specialist modellers and DWS planning teams
  - Best for infrastructure, operating rules, and system reliability



WATER BALANCE TOOL

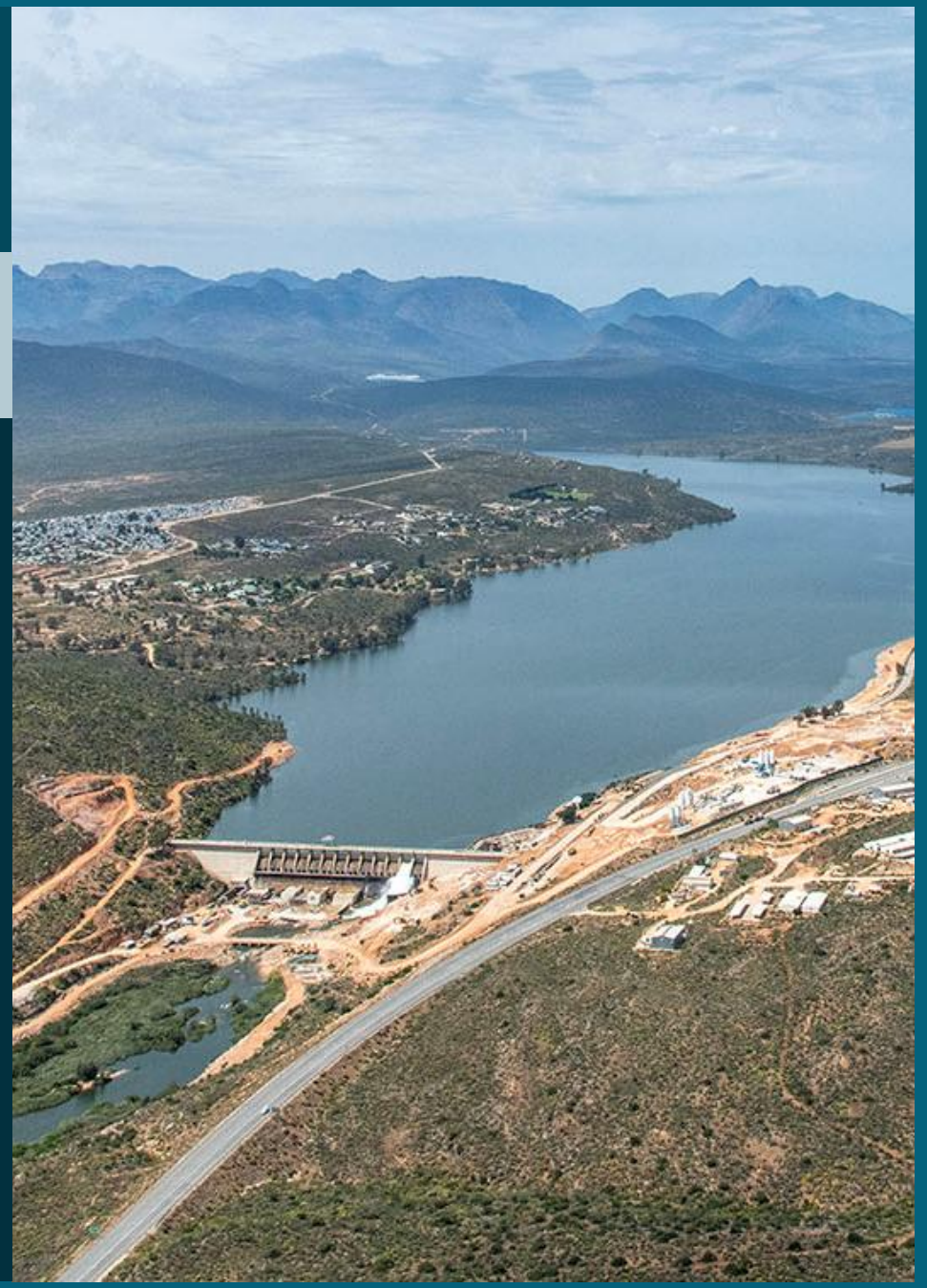
WHERE DOES IT FIT IN?

SWAT

Research-oriented watershed simulation model focused on land-use and hydrological processes, not practical catchment governance decisions

MIKE HYDRO Basin

Expensive, specialist-dependent, and less transparent to local users



WATER BALANCE TOOL

CONFIGURATION

CONFIGURE HYDROLOGICAL UNITS

- Sub-quaternary catchments
- Water routing – inflows and outflows

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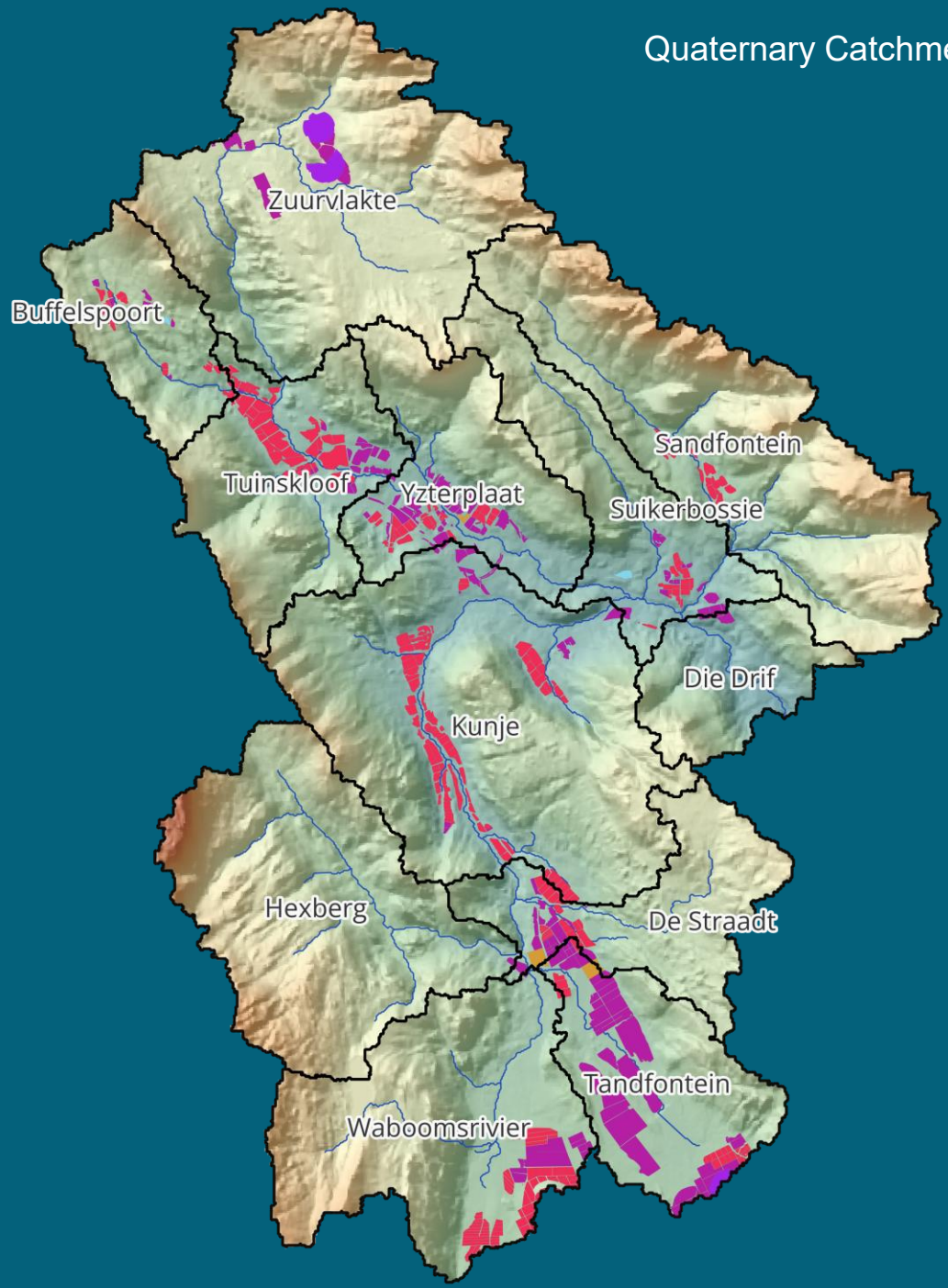

WATER BALANCE TOOL

CONFIGURATION

WATER DEMAND ESTIMATION

- Crop Areas & Types

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WATER BALANCE TOOL

CONFIGURATION

ABSTRACTIONS & STORAGE

- Dams, pumps, water transfers

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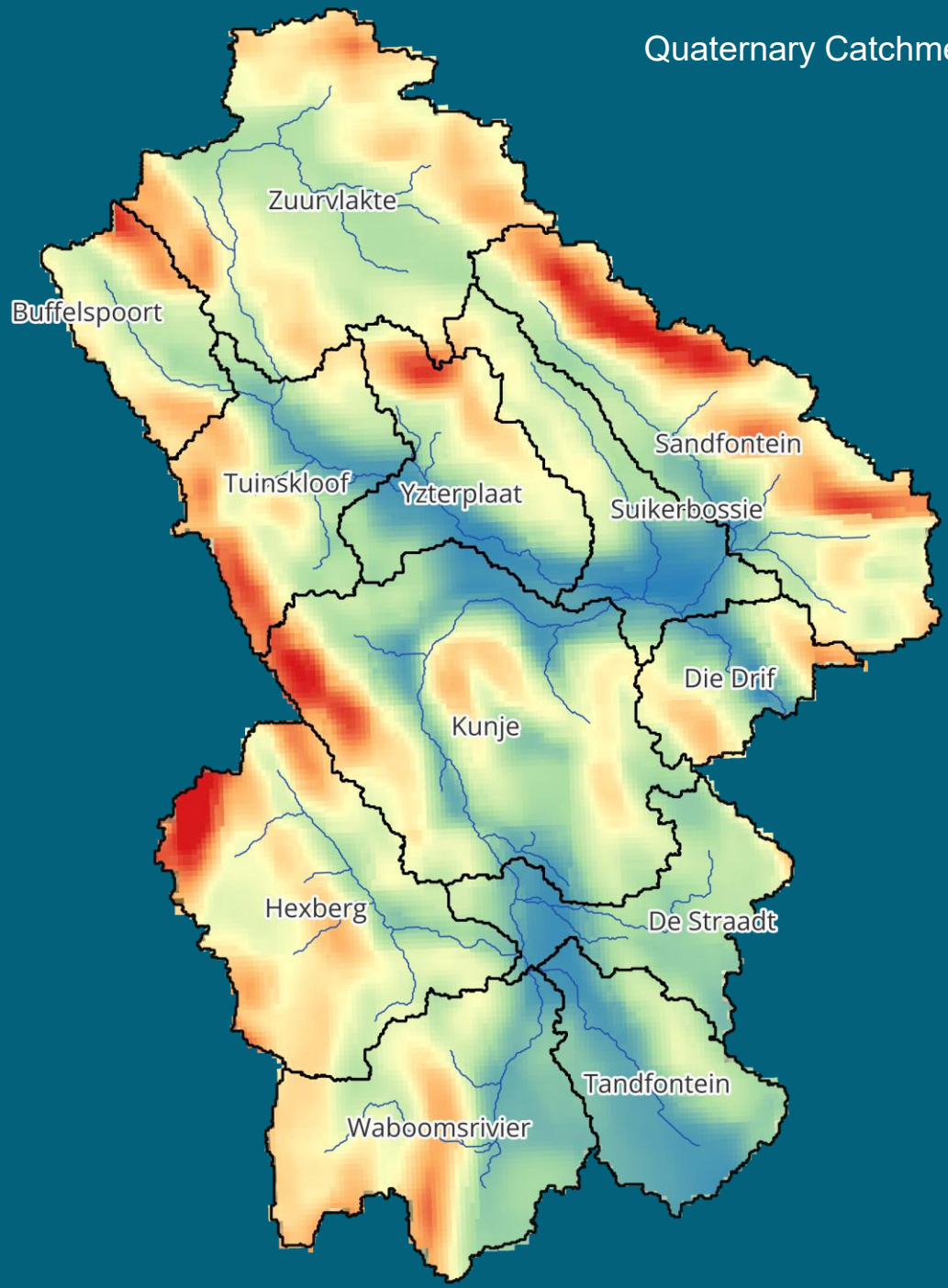

WATER BALANCE TOOL

CONFIGURATION

RAINFALL

- Water Source Areas

WATER BALANCE TOOL

CONFIGURATION

MONITORING NETWORK

- Streamfow & Rainfall

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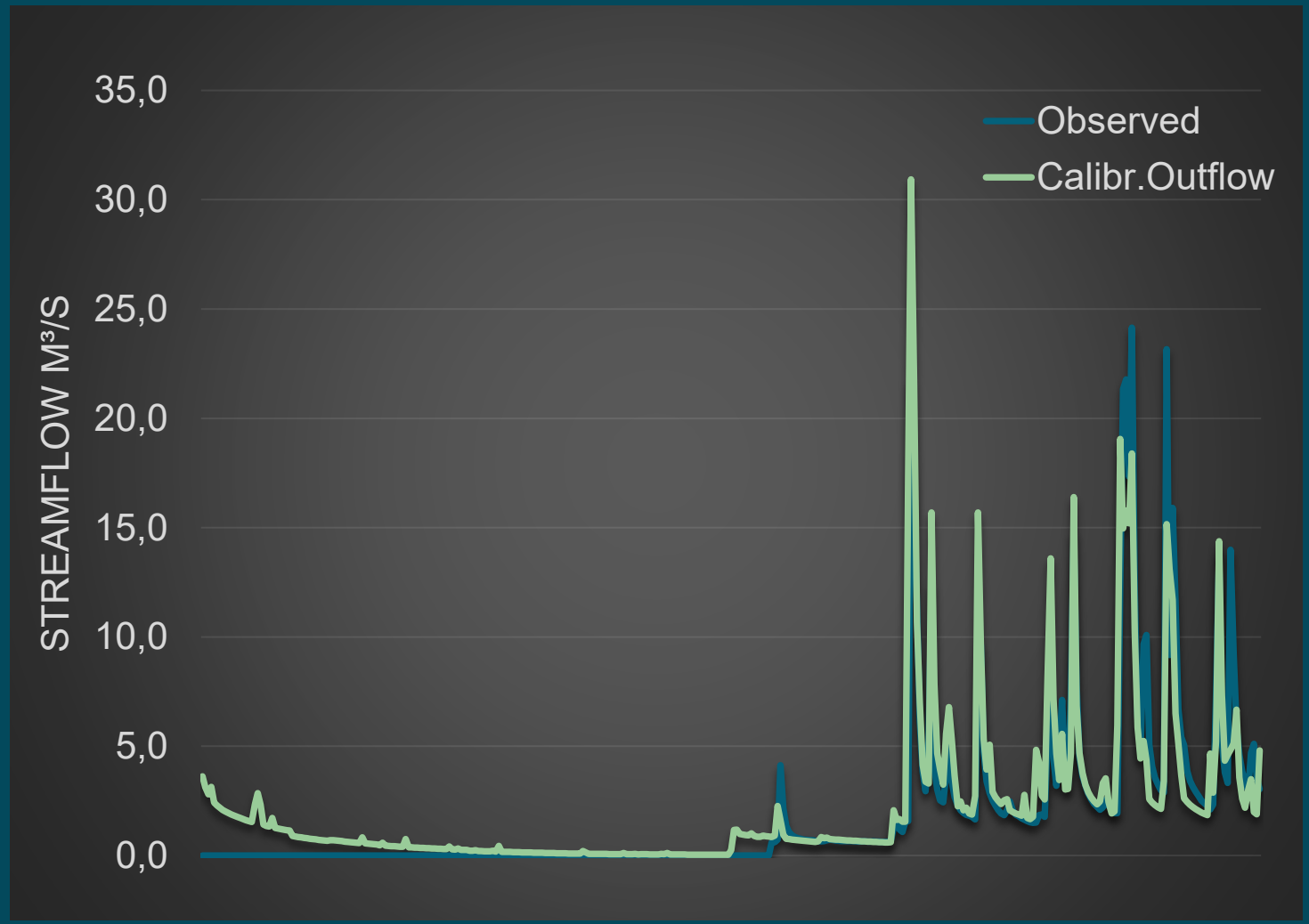
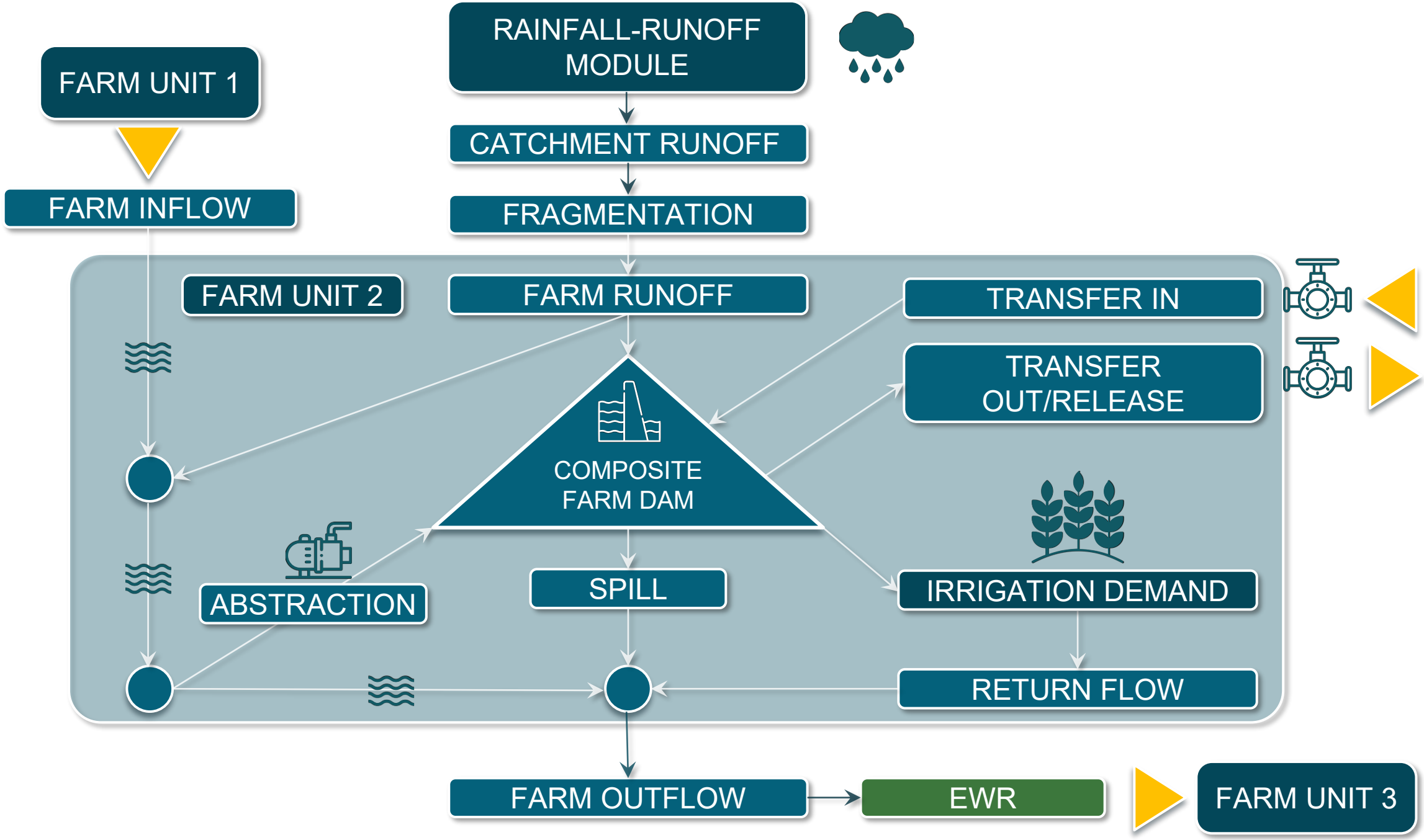
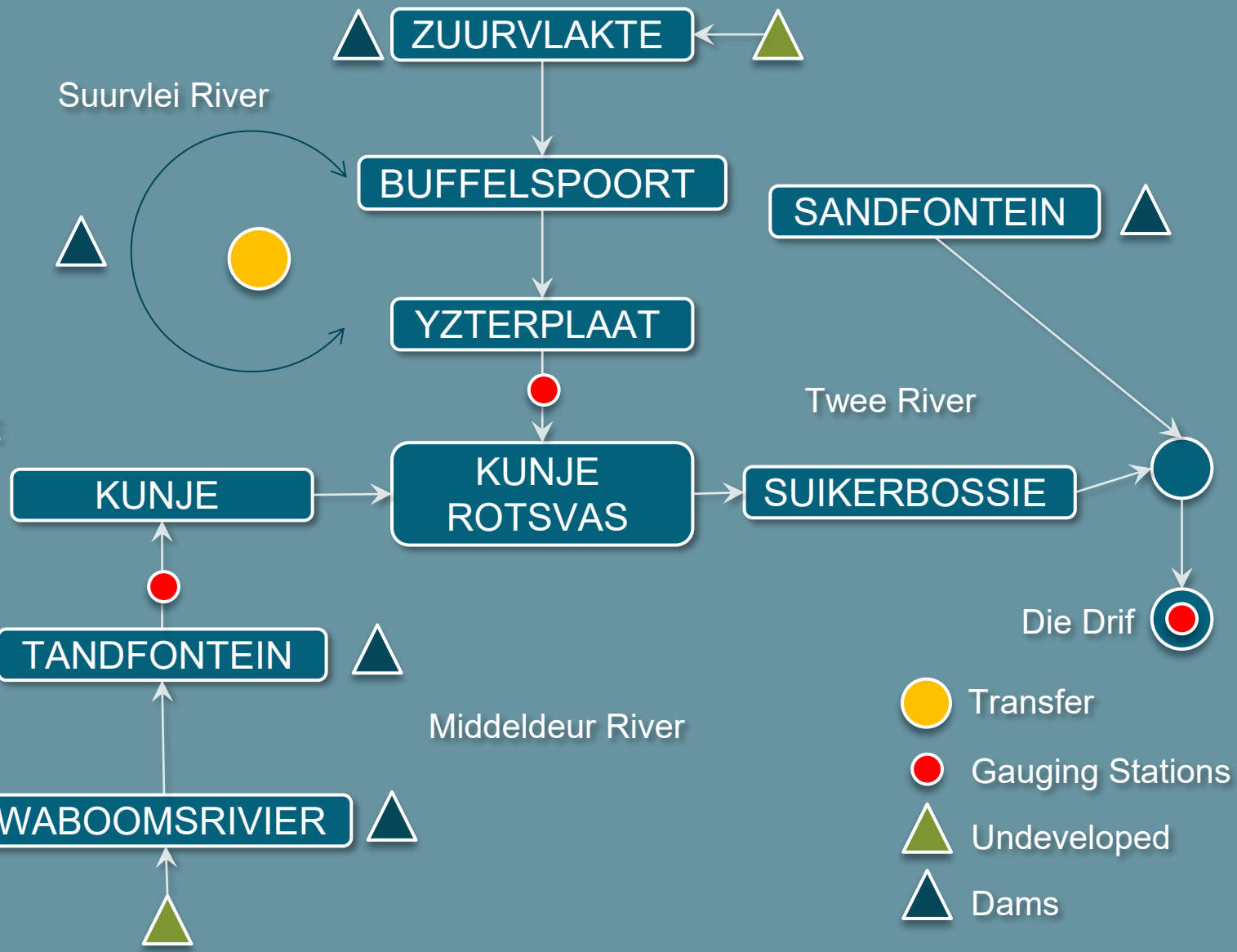
DAILY HYDROLOGICAL MODULE



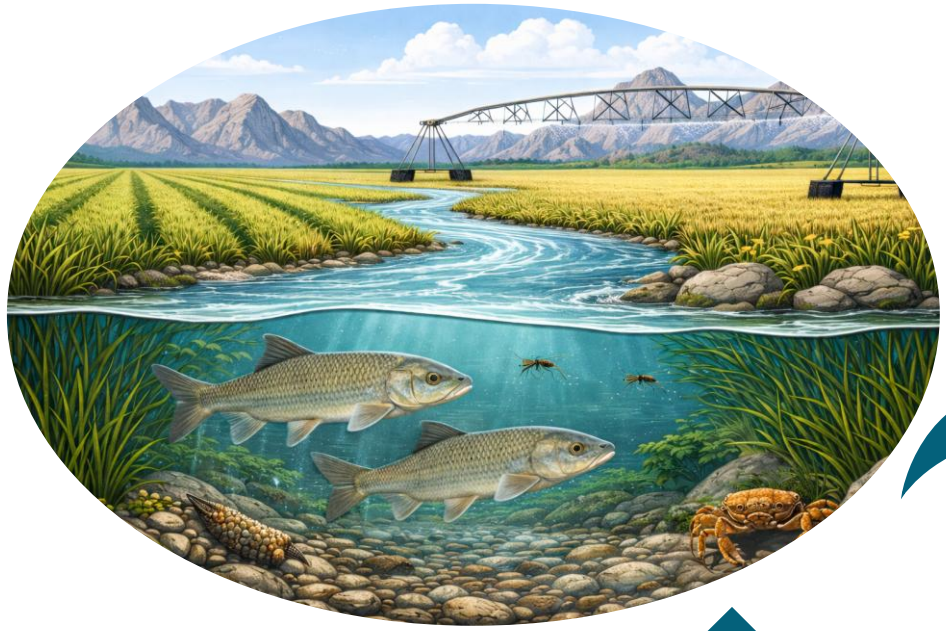
Year	nMAR (Mm^3)	PD MAR (Mm^3)
2010	*48,8*	*39,7*
2011	*60,0*	*53,8*
2012	*62,4*	*56,1*
2013	*76,9*	*70,5*
2014	*67,3*	*60,8*
2015	*33,4*	*27,6*
2016	*50,9*	*44,9*
2017	*21,6*	*16,3*
2018	*39,6*	*33,2*
2019	*49,7*	*43,1*
2020	*43,4*	*38,2*
2021	*32,4*	*25,8*
2022	*18,5*	*13,6*
2023	*47,2*	*40,5*
	46,6	*40,3*


RAINFALL-RUNOFF MODULE
FARM UNIT 1
CATCHMENT RUNOFF
FARM INFLOW
FRAGMENTATION
FARM UNIT 2
FARM RUNOFF
TRANSFER IN
TRANSFER OUT/RELEASE
COMPOSITE FARM DAM
ABSTRACTION
SPILL
IRRIGATION DEMAND
RETURN FLOW
FARM OUTFLOW
EWR
FARM UNIT 3

CATCHMENT NETWORK CONFIGURATION



SOCIO-ECOLOGICAL SYSTEMS



CATCHMENT DATA & INFORMATION

OPERATIONAL DECISIONS

WATER BALANCE TOOL

WATER BALANCE TOOL OUTPUTS

OPERATIONAL OUTPUTS

- **Daily flows –** at farm and catchment outlets
- **Storage levels –** in dams
- **Water use summaries –** (availability, abstraction, demand, deficit)
- **Ecological Reserve – compliance** indicators
- **‘Sharing-the-pain’ –** deficit reallocation during periods of water stress

STRATEGIC OUTPUTS

- **Scenario Planning –** Test rainfall and drought management strategies
- **Dam Storage –** Add/remove dams to assess sustainability impacts
- **Crop Replacement –** Switch to water-efficient crops or varieties
- **Climate Change –** Explore long-term impacts on water availability
- **Water Use Licenses** – testing additional dams and abstraction on whole system

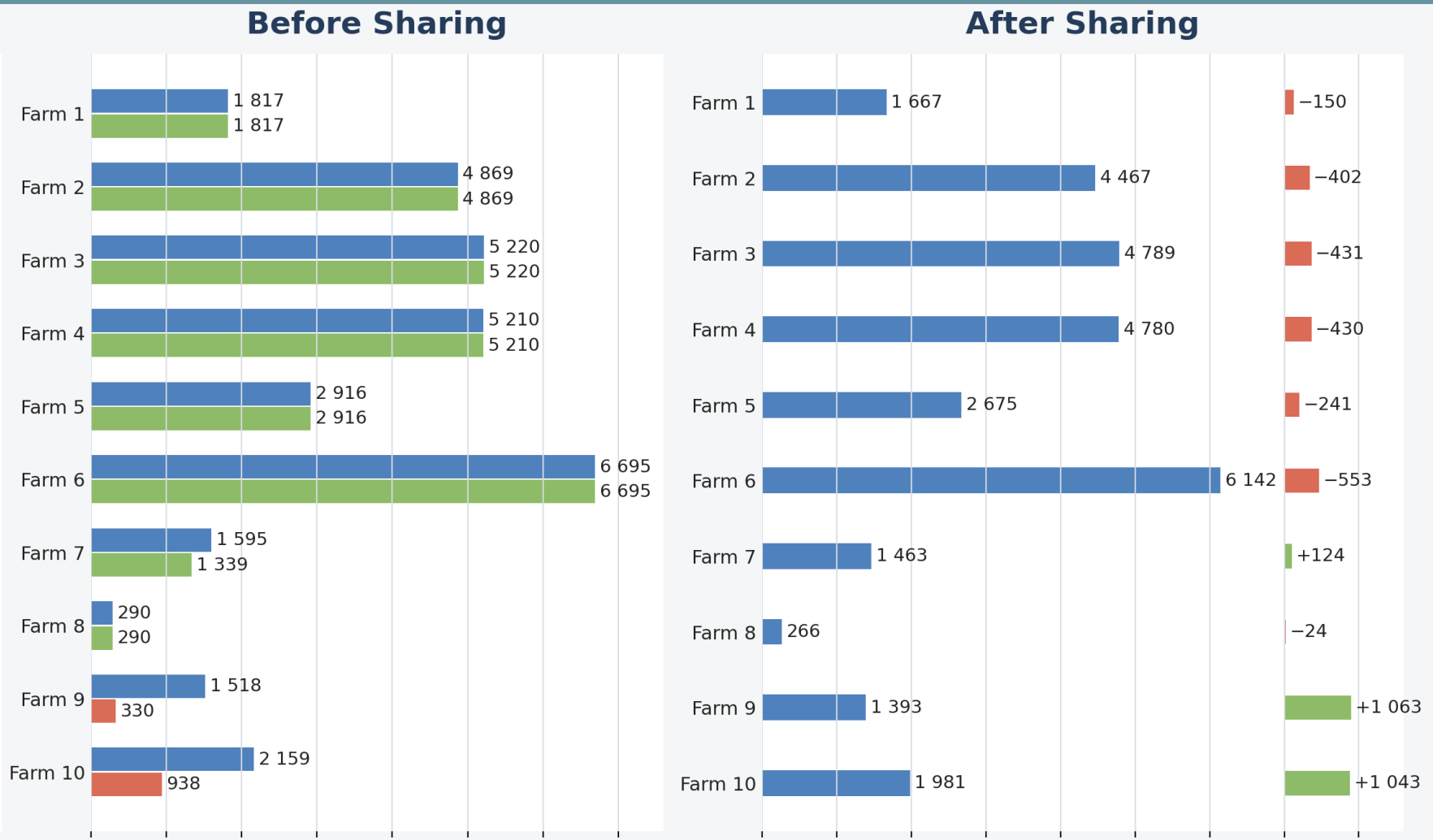
‘SHARING THE PAIN’

Catchment Water Balance

Total Average Demand
32 289 m³/day

Total Average Supply
29 624 m³/day

Average Deficit
−2 665 m³/day



Blue = irrigation demand / target allocation Green = increase in supply Red = reduction in irrigation

WATER BALANCE TOOL

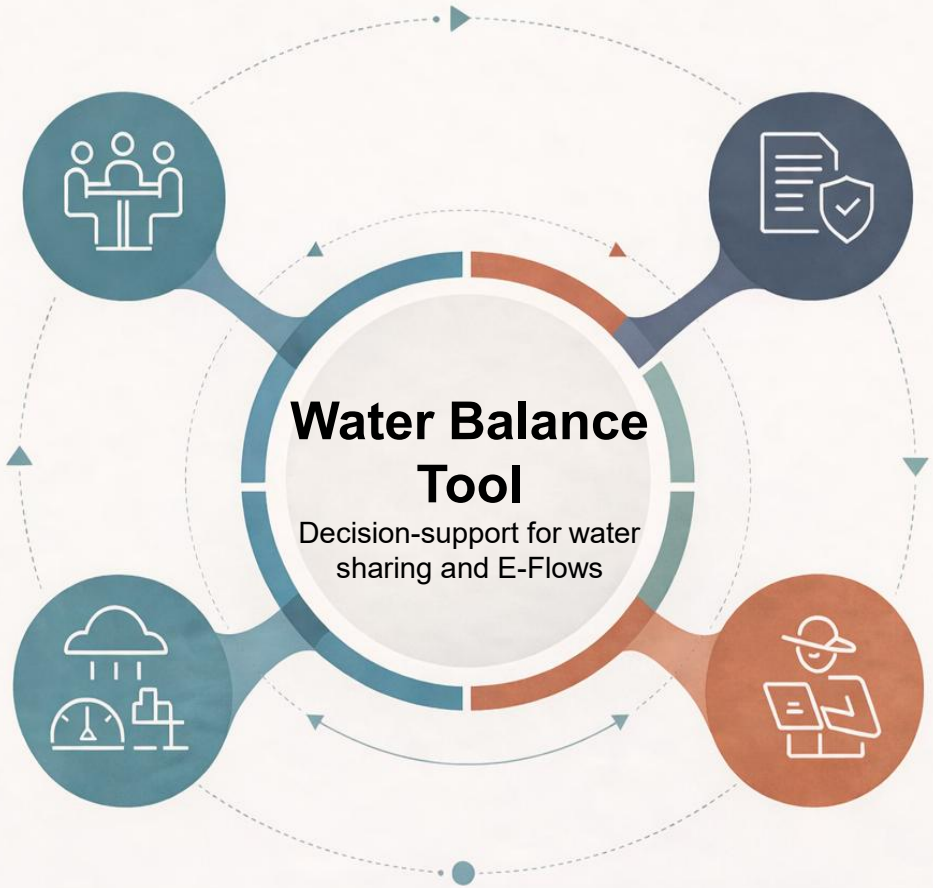
Historical Scenario Envelopes

- **Tier 0 (≥95%)** – Normal use, EWR applies, monitor flows.
- **Tier 1 (85–94%)** – Small shortage: cut irrigation ±10–15%, EWR applies.
- **Tier 2 (70–84%)** – Medium shortage: cut ±25–30%, share fairly, EWR curtailed.
- **Tier 3 (55–69%)** – Serious shortage: cut ±35–45%, equalisation rules, EWR curtailed.
- **Tier 4 (<55%)** – Emergency: protect minimum river flows, only critical crops irrigated, daily coordination.

Institutional & Governance Frameworks

Institutional Capacity
- WUAs (Operational Home)
- Catchment Forums
- Allocation Rules
- Shared-Decision Making

Regulatory Authority
- Government Oversight
- Catchment Forums
- Licensing System
- Catchment Management Strategy



Monitoring Systems
- Rainfall Stations
- Flow Gauges
- Dam Storages
- Pumping Rates

Operational Capacity
- Catchment Coordinators
- Field Data Collection
- Monthly Water Accounting
- Stakeholder Engagement

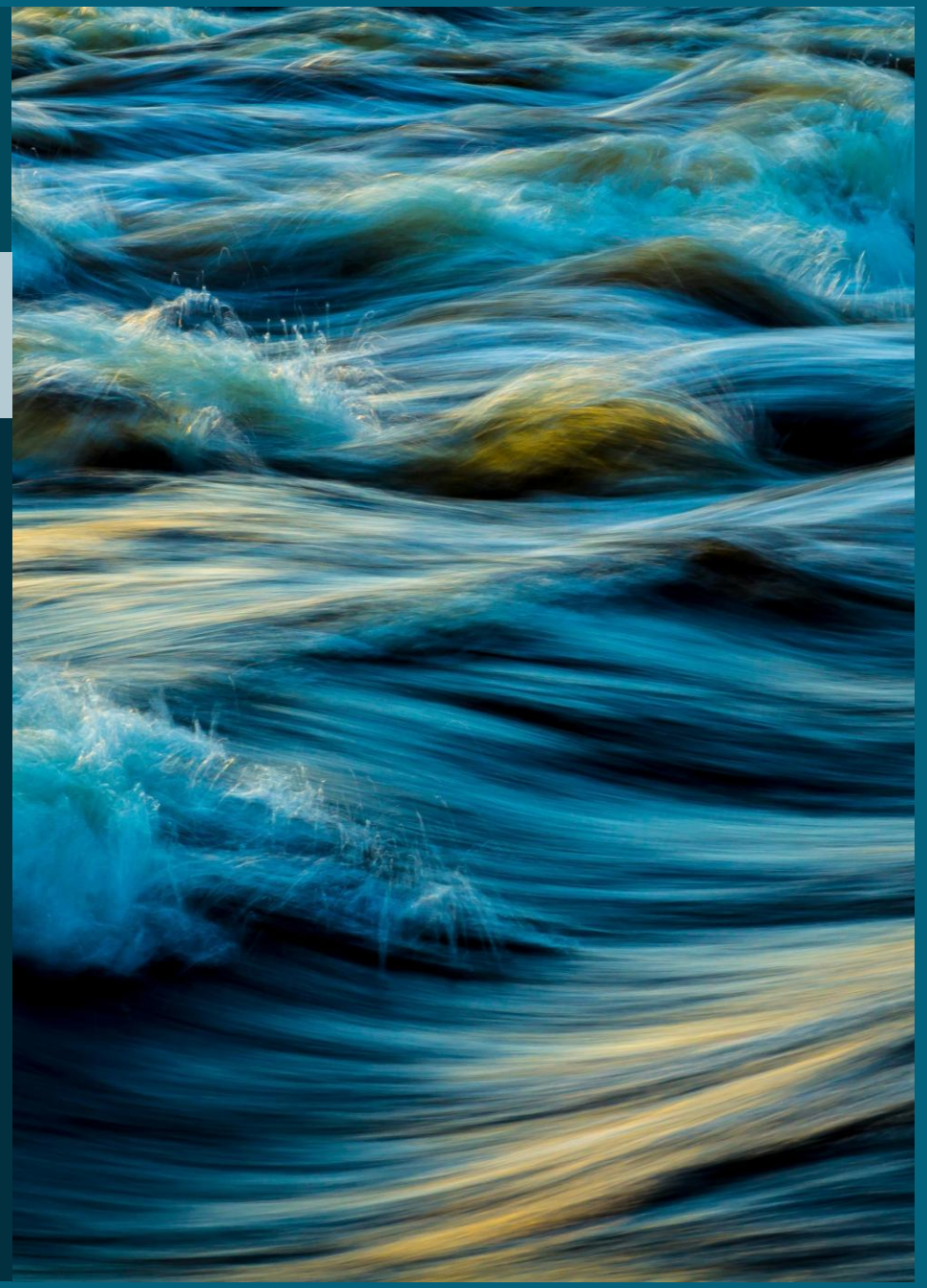
Only works within a functioning system of governance, monitoring and operational capacity

WATER BALANCE TOOL

LOOKING AHEAD

Phase 1 – Platform Development

- Build online platform, automate data feeds, enable secure multi-user access

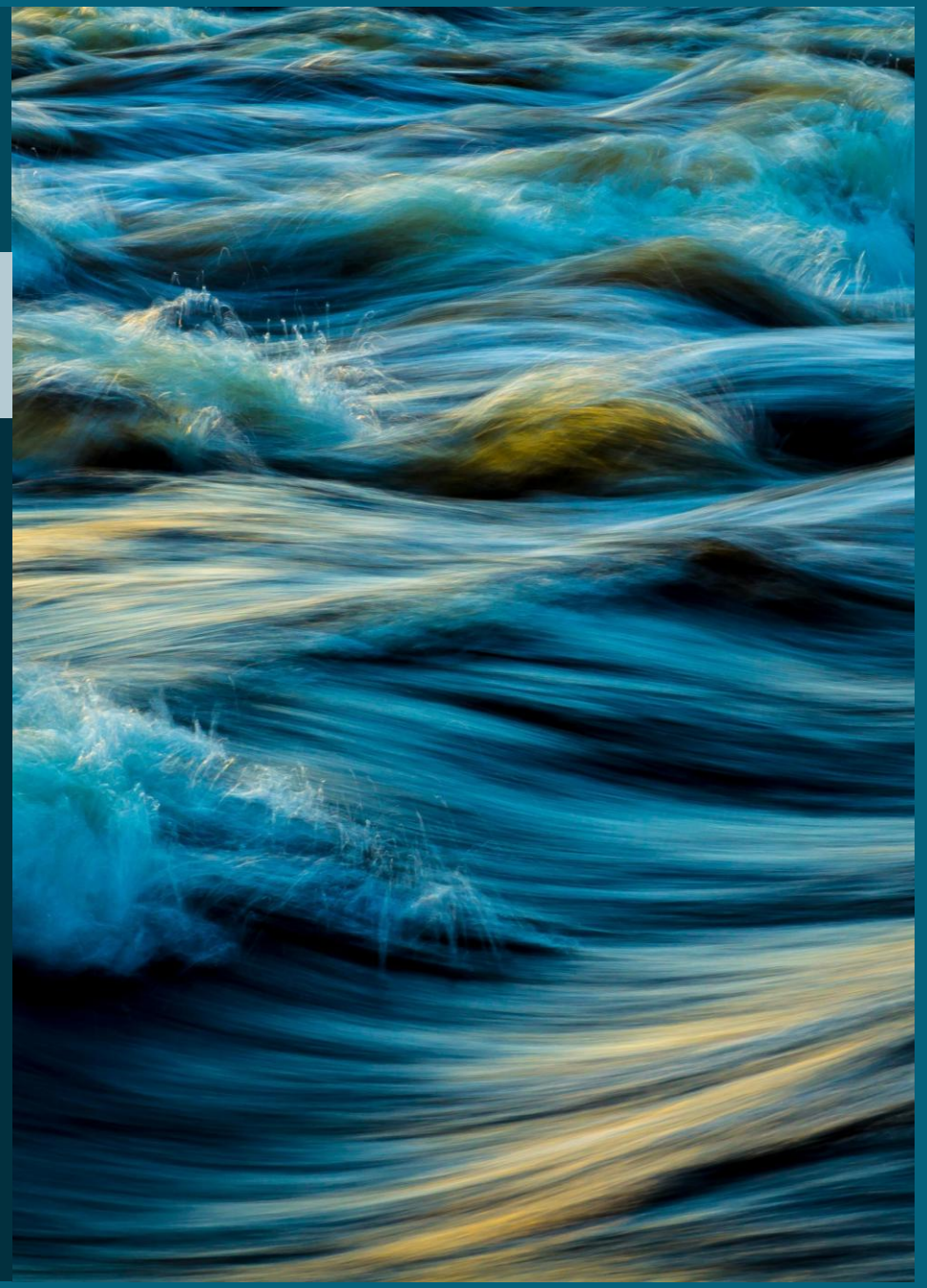


WATER BALANCE TOOL

LOOKING AHEAD

Phase 2 – Pilot Implementation

- Deploy in Verlorenvlei, Citrusdal, Koue Bokkeveld and Barrydale
- Refine with landowners and WUAs



WATER BALANCE TOOL

LOOKING AHEAD

Phase 3 – Institutional Integration

- Integrate with existing systems; train institutions;
- Scale to Strategic Water Source Areas