



| 10 YEAR ANNIVERSARY |

Ephemeral Pans



Balance developer perceptions with strict legal requirements

**Our reliabilism
has a direct,
significant, positive
correlation
to the value we ascribe**

C. Neethling

Reliabilism...



I know ***something reliably***



If and only **if** knowledge and belief



Are experienced



Can be explained



Have been (de)constructed

Knowledge



Without experience

Experience

April 26



6

Without knowledge

How do we Explain pans

Apr

The Developer's Lens



- Perception:** Crusted-up bare depression.
- Value:** Zero. A convenient place for a drill rig laydown area or a 4x4 turning point.
- Frustration:** Baffled by strict regulations for just dirt.

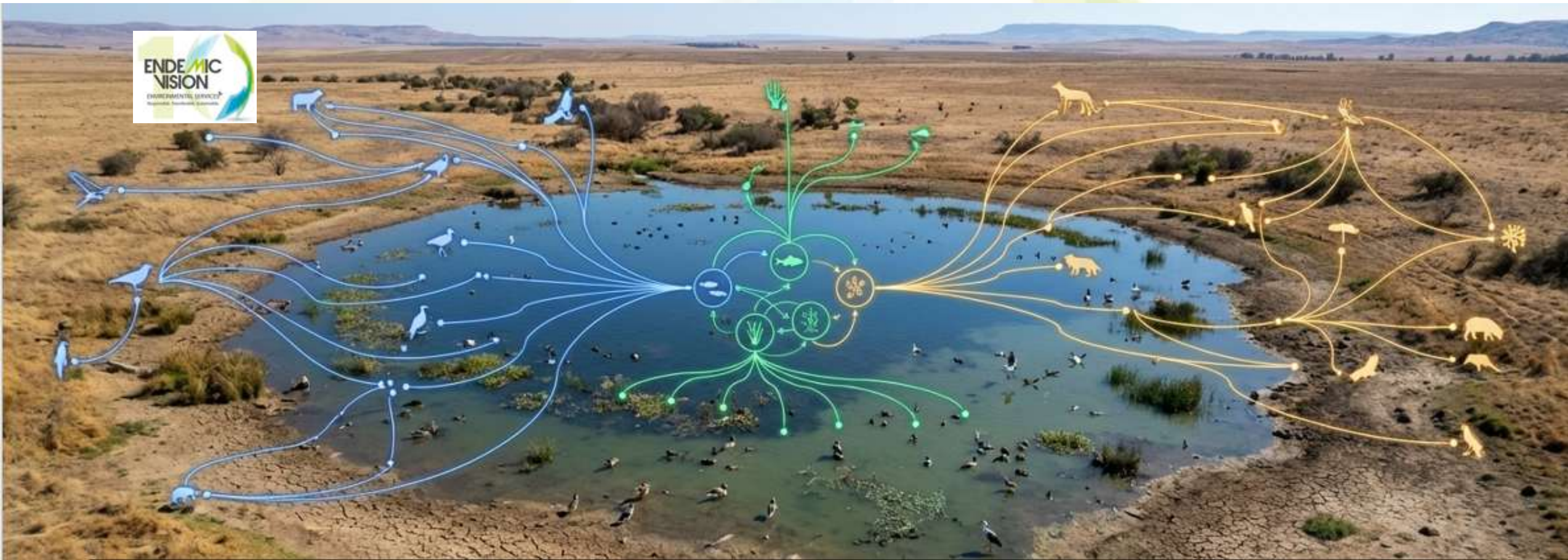
The Regulatory Lens



- Perception:** Intermittent Wetland (NEM:BA Section 52).
- Value:** High. A threatened, protected ecosystem (e.g., Southern Kalahari Salt Pans, Bushmanland Vloere).
- Mandate:** Requires the full suite of permanent wetland regulations and strict residual impact offsets.

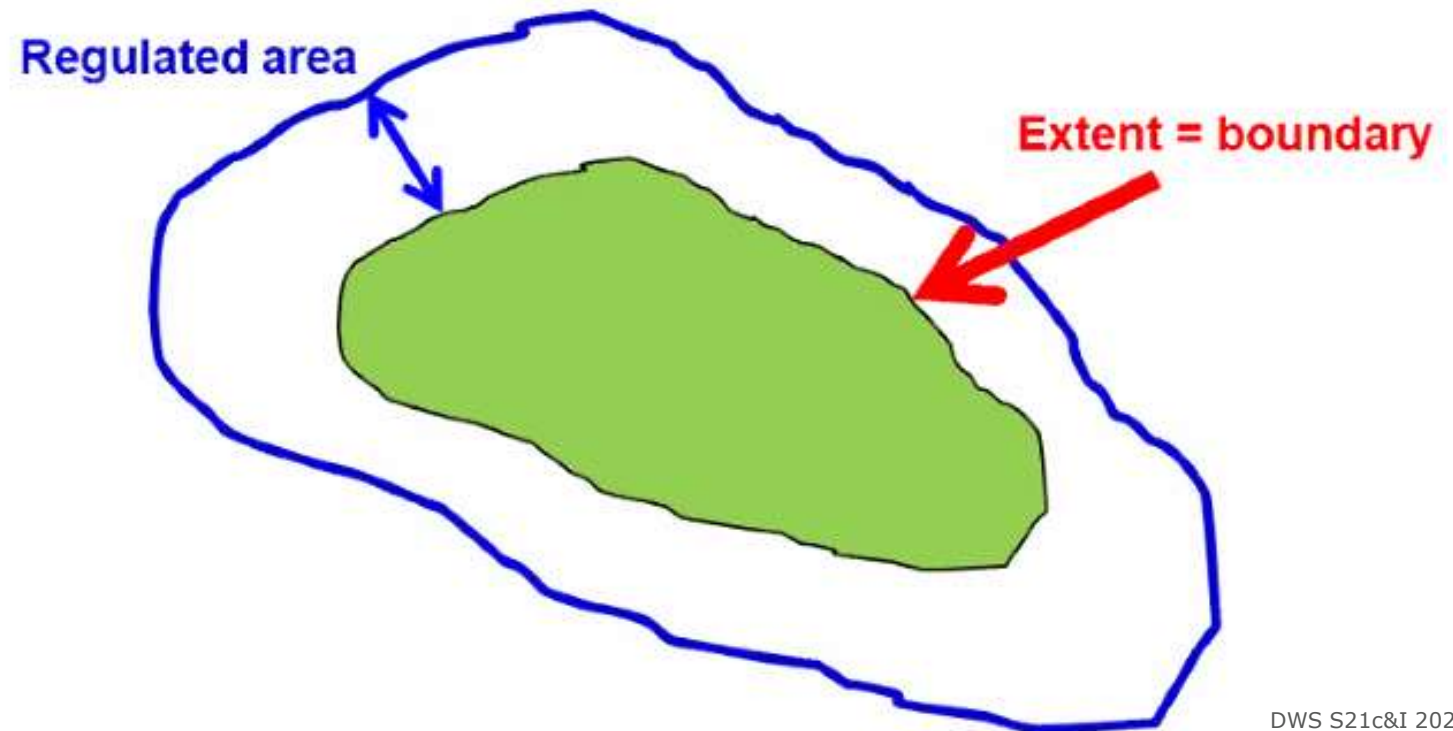


De (Construction)



Wetlands

land which is transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.



Pans are Ephemeral Wetlands

Intermittent, holding surface water for irregular periods of less than one season at intervals varying from less than a year to several years.

Of which some are endoreic.

21% of SA wetlands are Endoreic

A closed drainage basin that retains water and allows no outflow to other external bodies of water

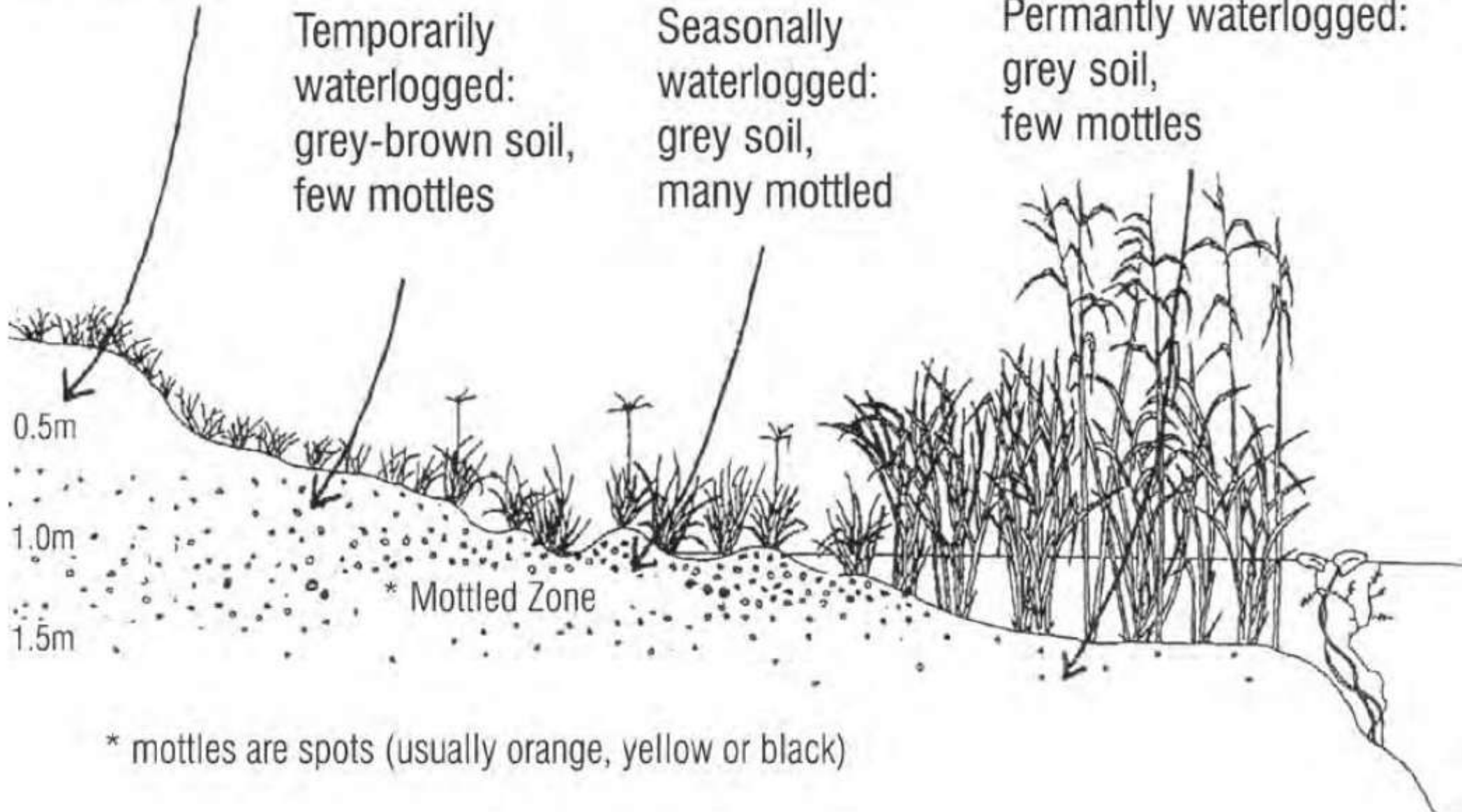
NON-
WETLAND

WETLAND

Temporarily
waterlogged:
grey-brown soil,
few mottles

Seasonally
waterlogged:
grey soil,
many mottled

Permanently waterlogged:
grey soil,
few mottles



Wetlands must have one or more of the following attributes:

Wetland hydromorphic soils that display characteristics resulting from prolonged saturation.

The presence, at least occasionally, of water-loving plants (Obligate, Facultative and Preferential species)

A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil.

Legal Requirements

- 👉 NEMA EIA Regulations
 - 👉 NEMA EIA Specialist Assessments
 - 👉 NEMA 100-meter buffer
 - 👉 NEMBA – Important ecosystems = NFEPA & CBA
-
- 👉 NWA Regulation 704 exemption
 - 👉 NWA 500-meter buffer
 - 👉 NWA Section 21 (c&i) general authorisation

Other requirements

DWS wetland identification and Delineation

-  standardised procedures mandated by DWS

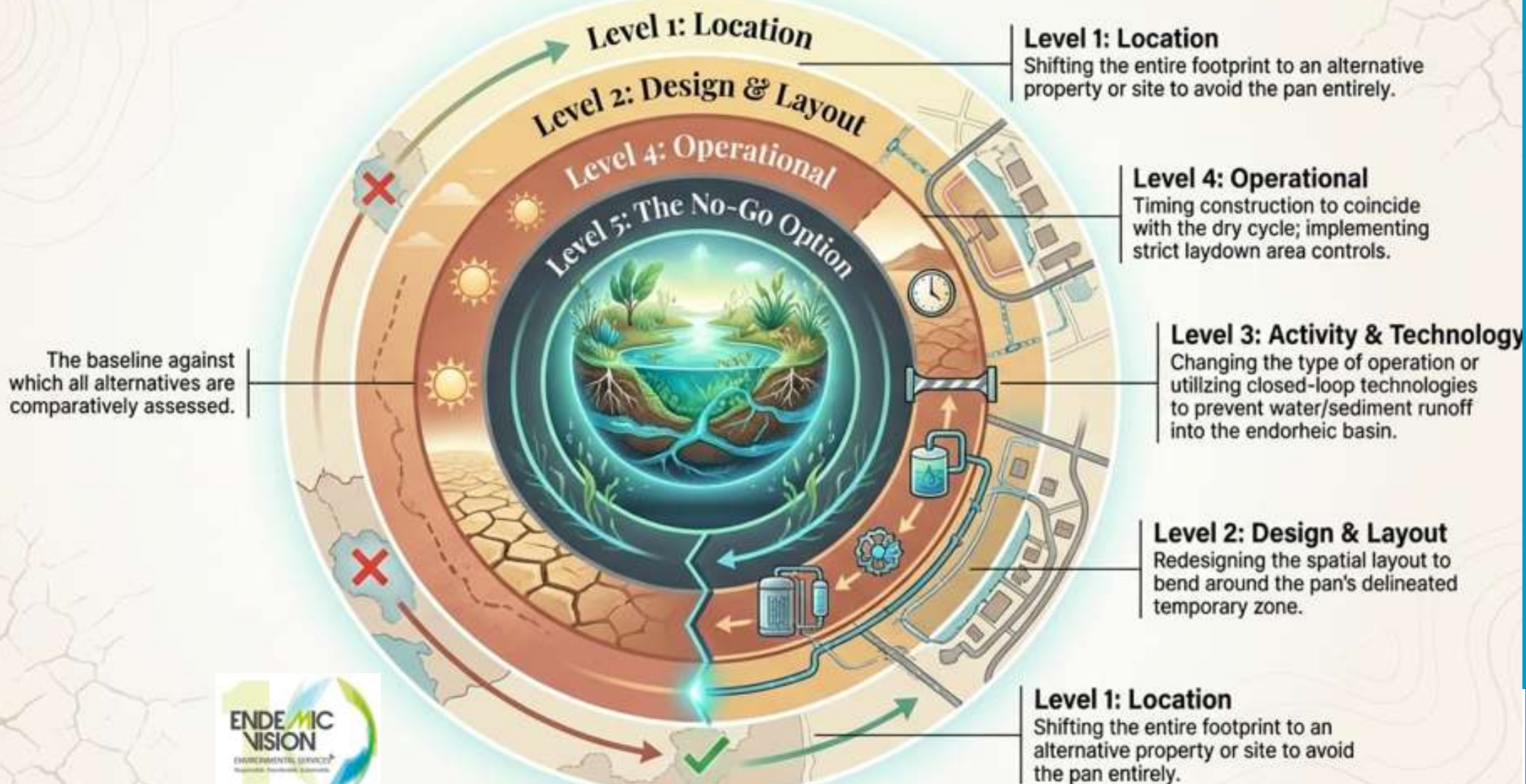
Biodiversity offset policy & Wetland offsets guideline.

-  Wetland offsets are required if residual impact triggers offset or as a condition of development approval (environmental authorisation)



NEMA Assessment of Alternatives

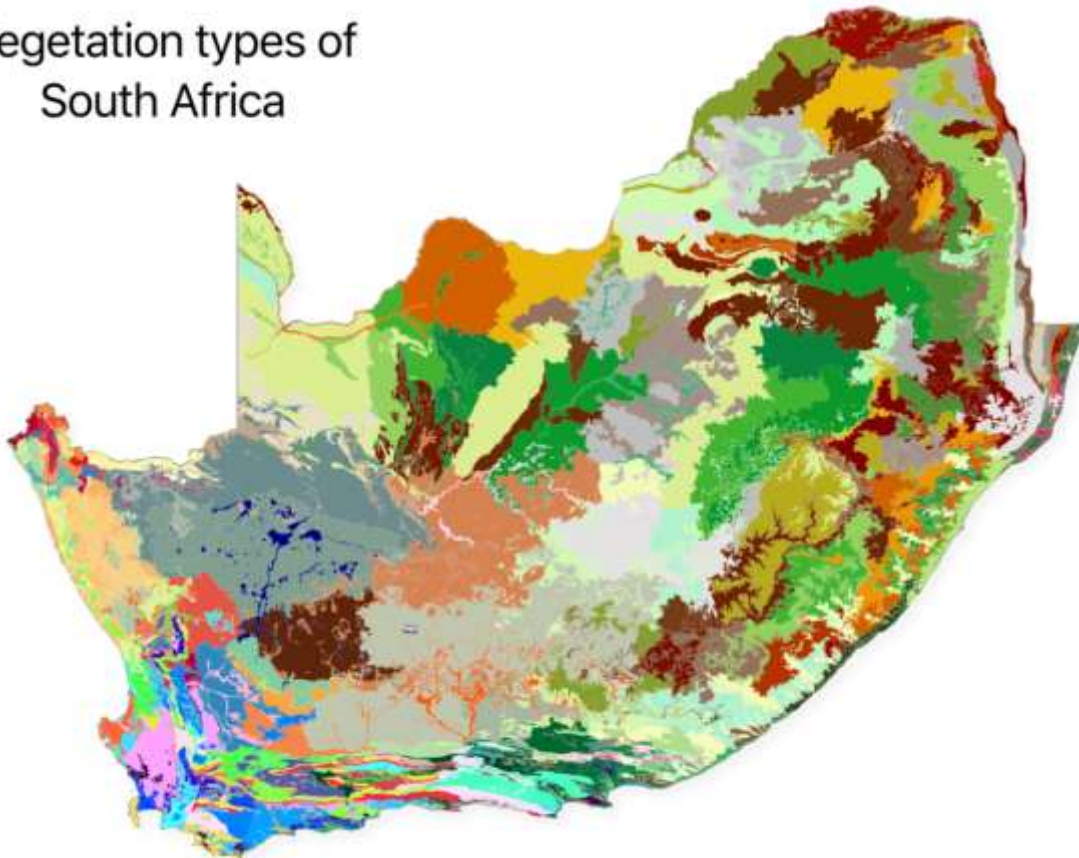
The EIA Mandate: Navigating the Hierarchy of Alternatives



Representation

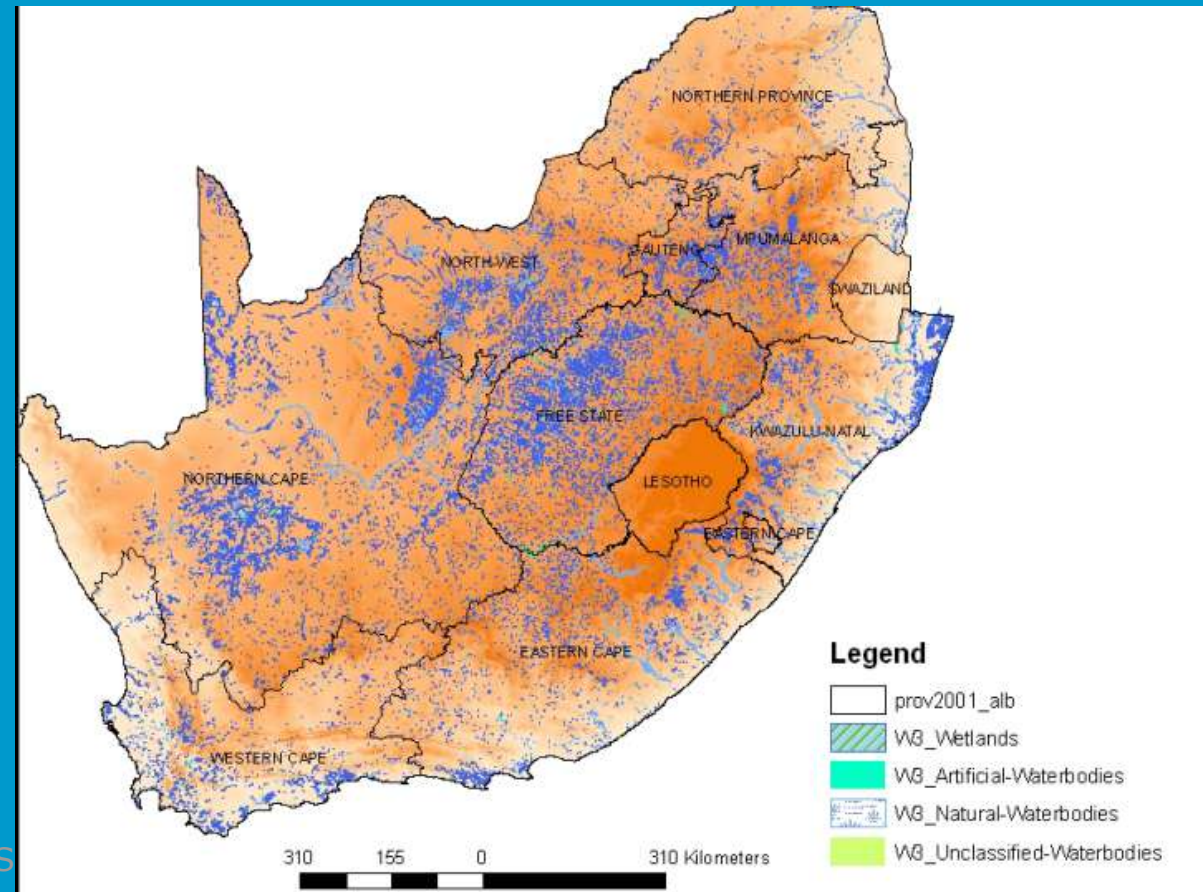
2011 VS 2024 VEG MAP Southern Kalahari Salt Pans (AZi4) Bushmanland Vloere (AZi5)

Vegetation types of
South Africa

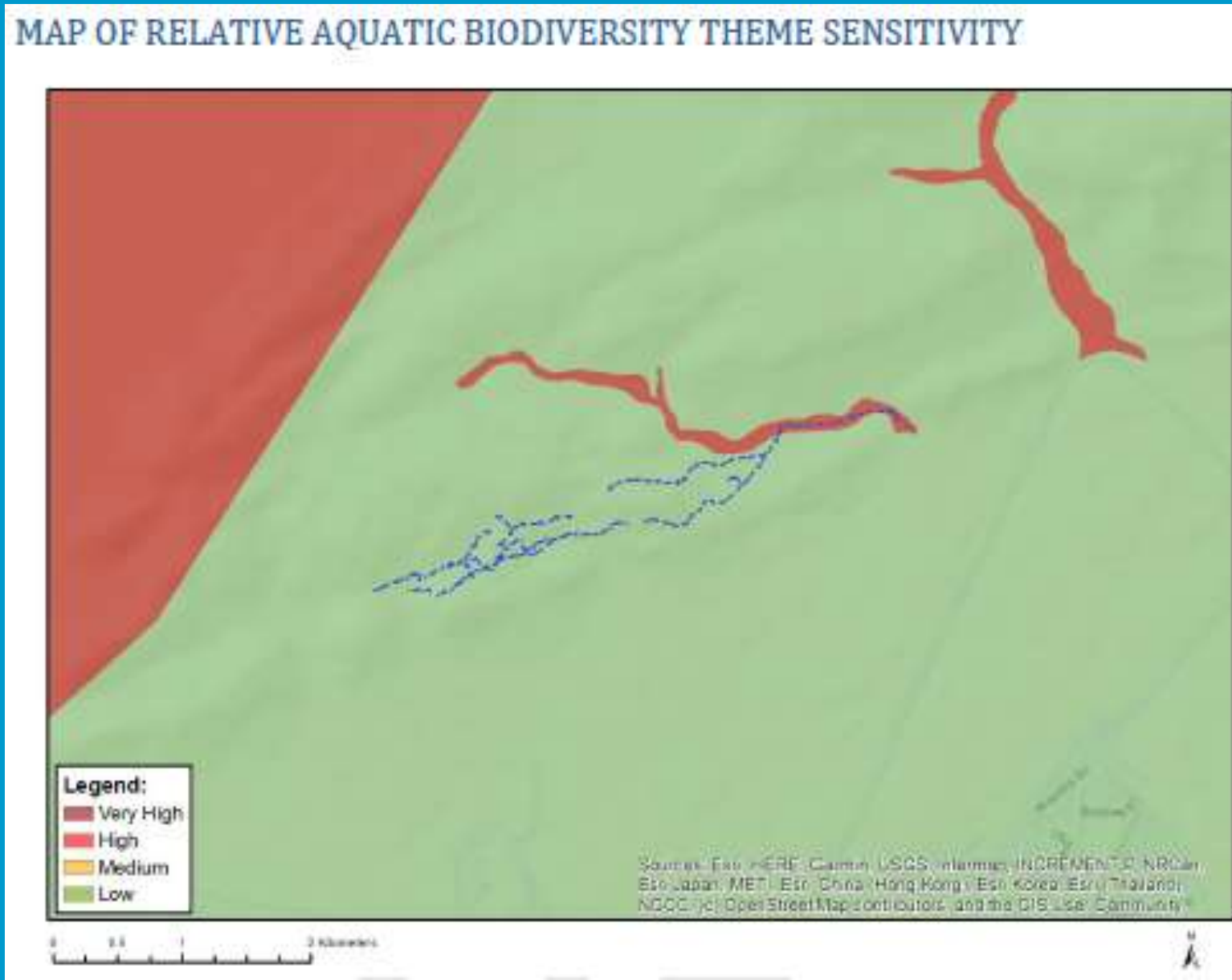


IA NC FS

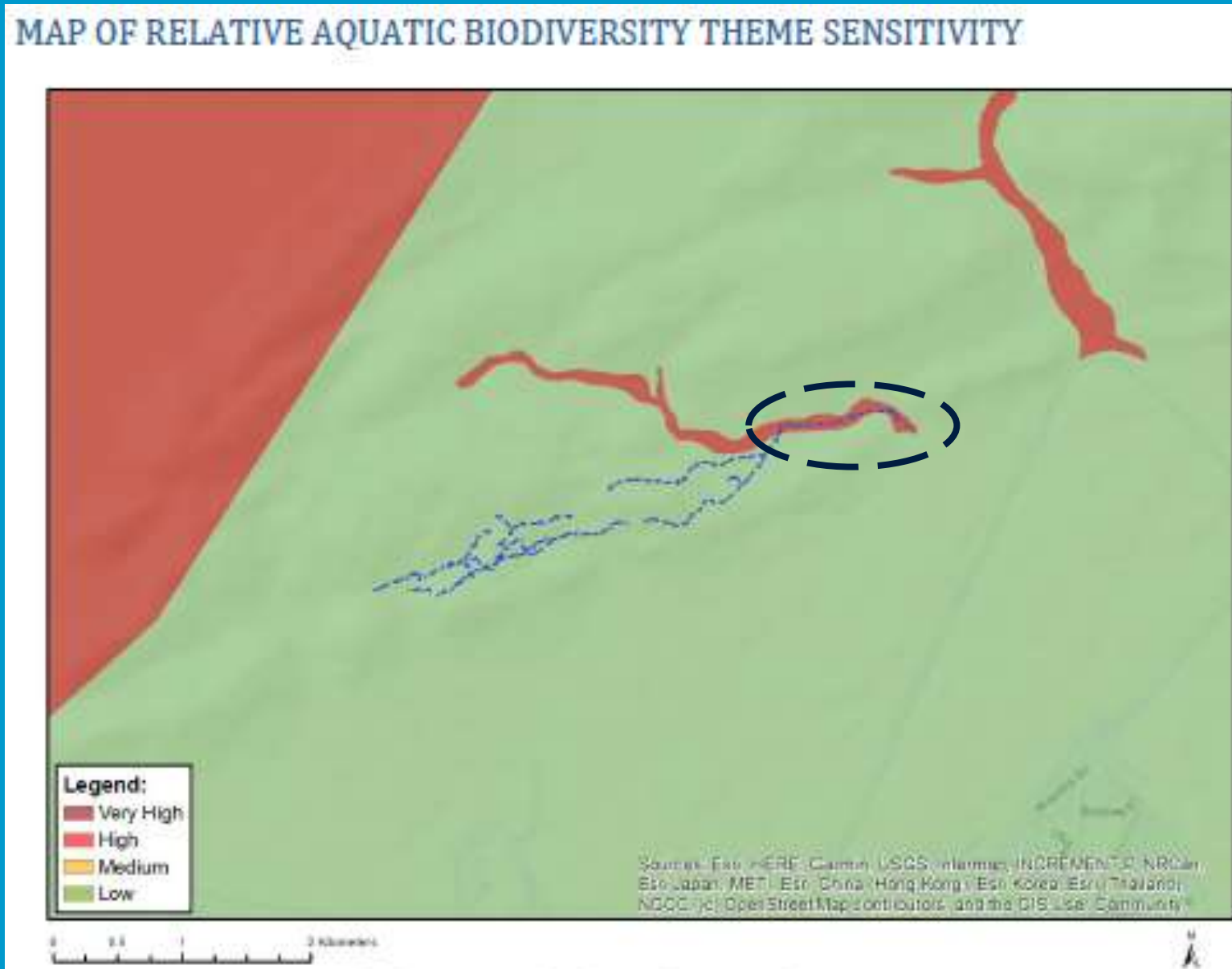
National Freshwater Ecosystem Priority Areas (NFEPA)



Regulatory Screening report for an EA

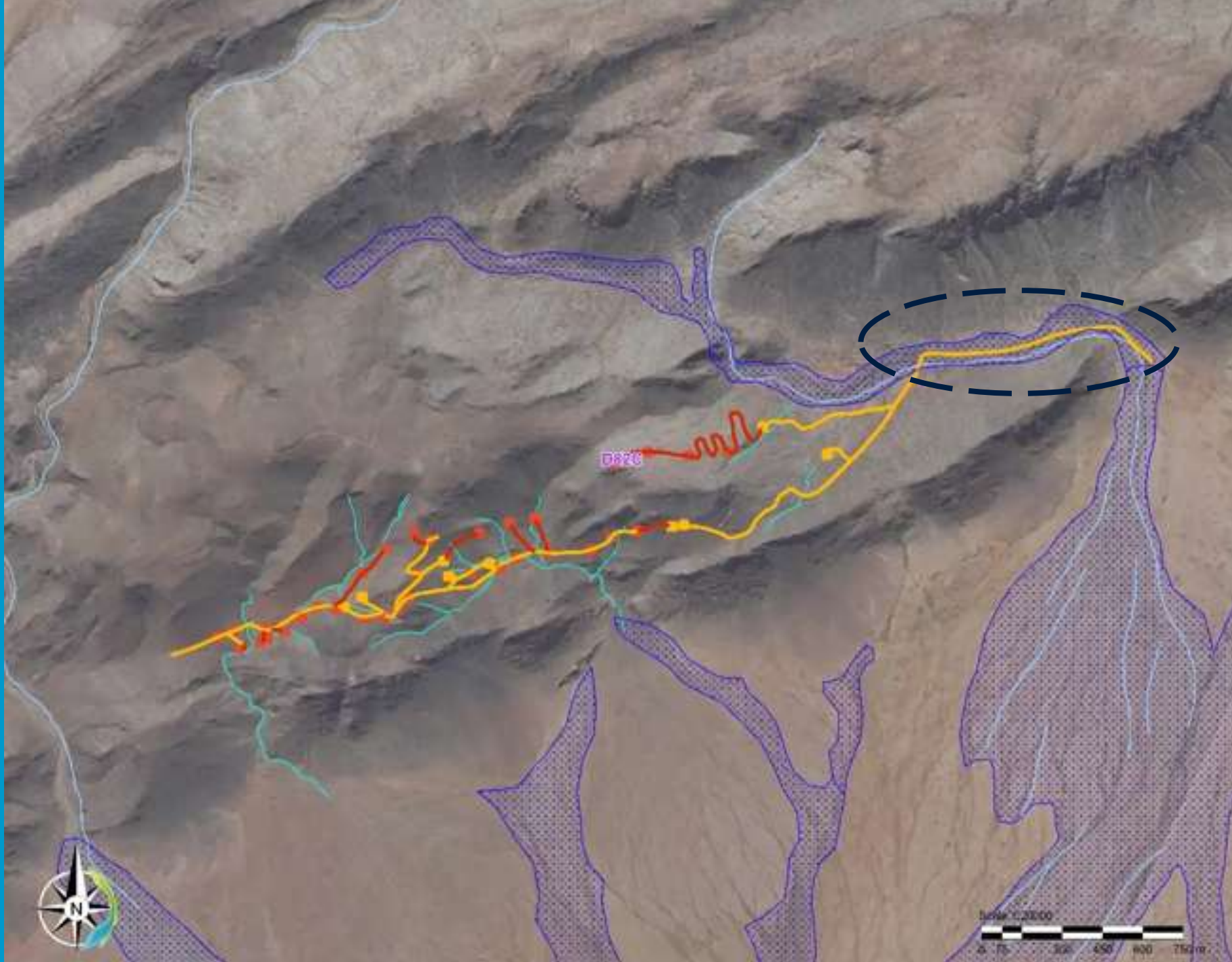


Regulatory Screening report for an EA



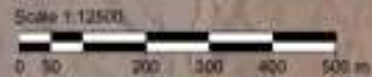
Orthophoto image Supported by GIS water feature layer

April 26



Orthophoto image Supported by GIS water feature layer

April 26



Critical Biodiversity Areas

CBA – Northern Cape 2024

April 26



Legend

▲ Parent farms

■ PA

NC CBA 2024

■ CBA1

■ CBA2

■ ESA

■ Other Natural

✕ Pans



CBA – Northern Cape 2024

EXPERIENCE
WITHOUT KNOWLEDGE IS BLIND

BUT KNOWLEDGE WITHOUT
EXPERIENCE IS LAME

Experiencing Pans

April 2



Natural NFEPA Slope Wetland

Optical phenomenon





Ephemeral Pans are low-valued nice places

Responsible. Transferable. Sustainable.

Natural NFEPA Valley Floor Wetland





Natural NFEPA Valley Floor Wetland



10 m

Natural NFEPA Valley Floor Wetland

Non-NFEPA Wetland

Ground verified delineation
overlay on drone imaging



Ground verified delineation overlain
on drone imaging

Non NFEPA Wetlands in Ephemeral Rivers

**Artificial
Valley Floor**

Scale 1:2000
0 15 30 45 60 75 m



**Natural
Non-NFEPA**

Scale 1:2500
0 20 40 60 80 100 m

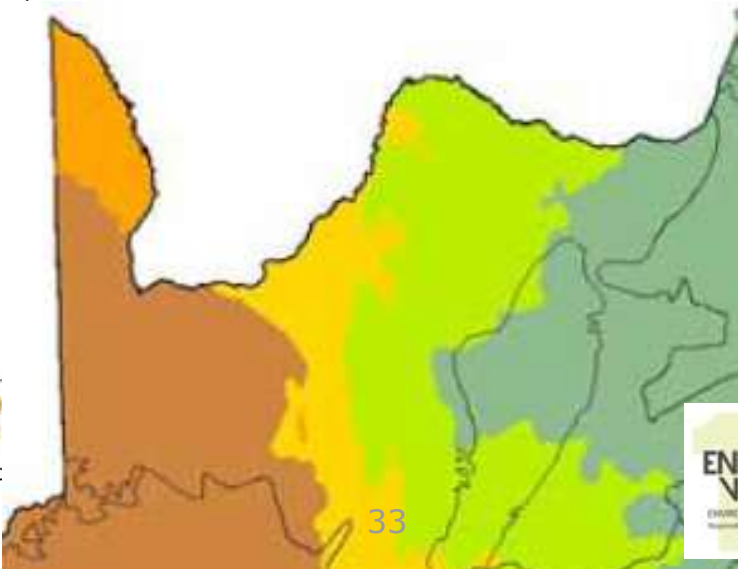
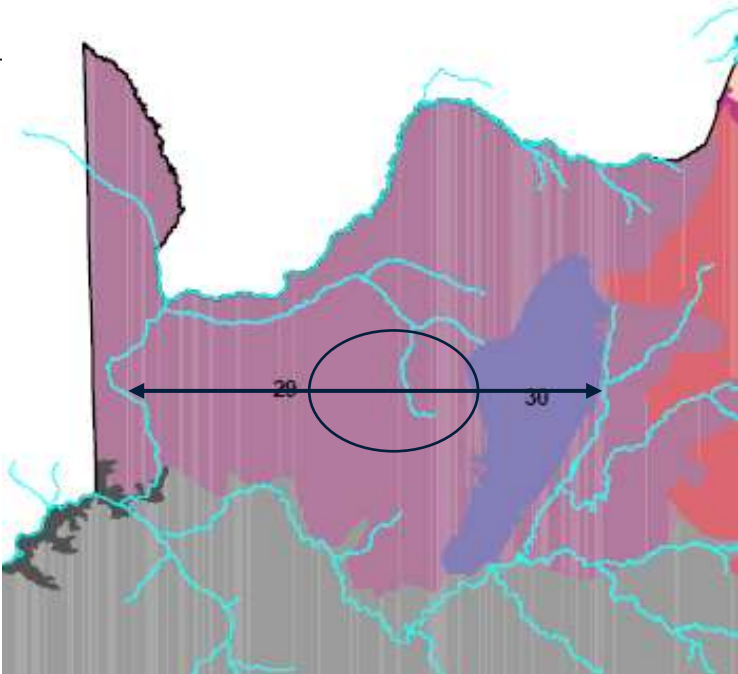
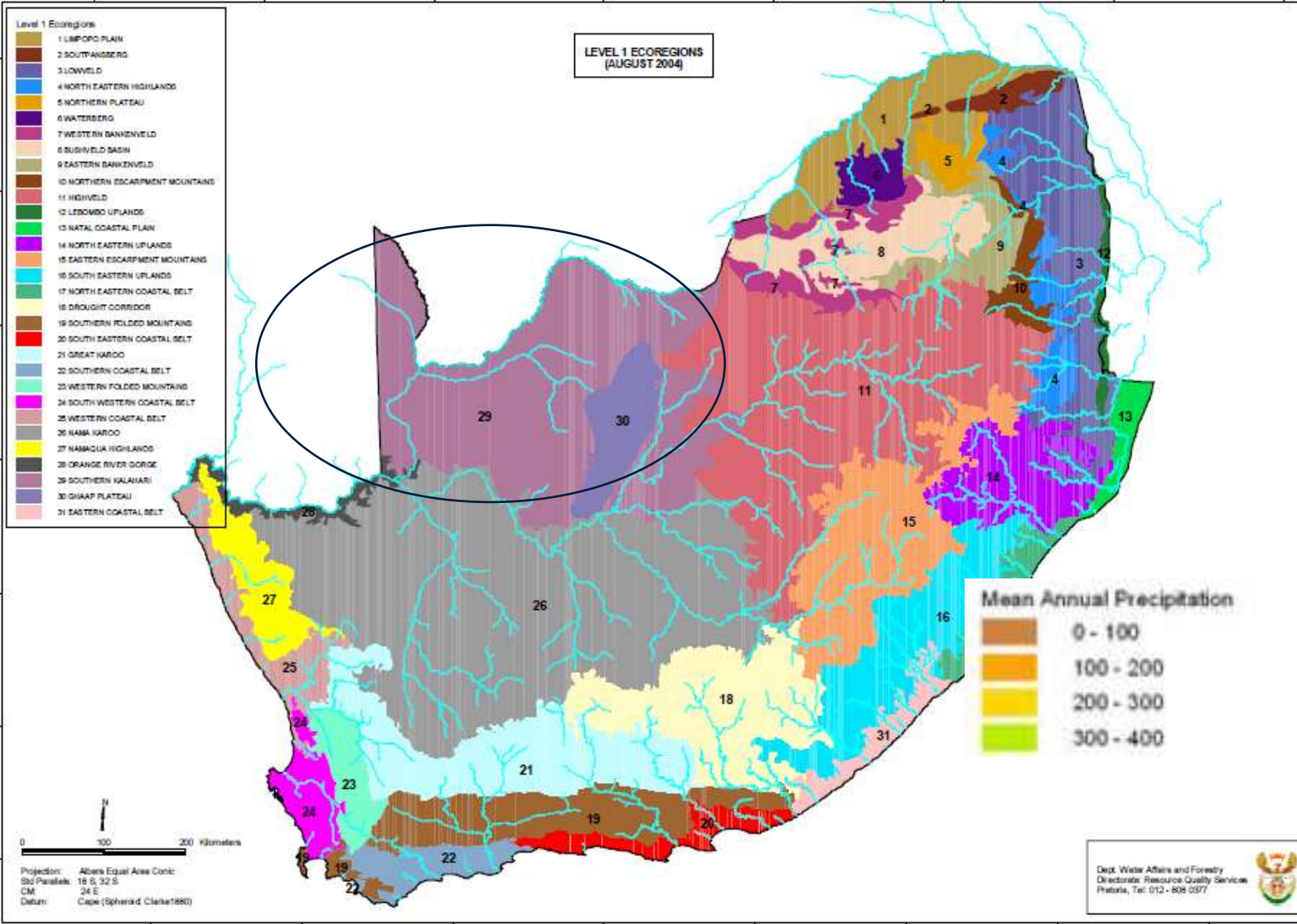


Ephemeral Pans are unique structural niches in an otherwise homogenous landscape

Responsible. Transferable. Sustainable.



Southern Kalahari Ecoregion 29

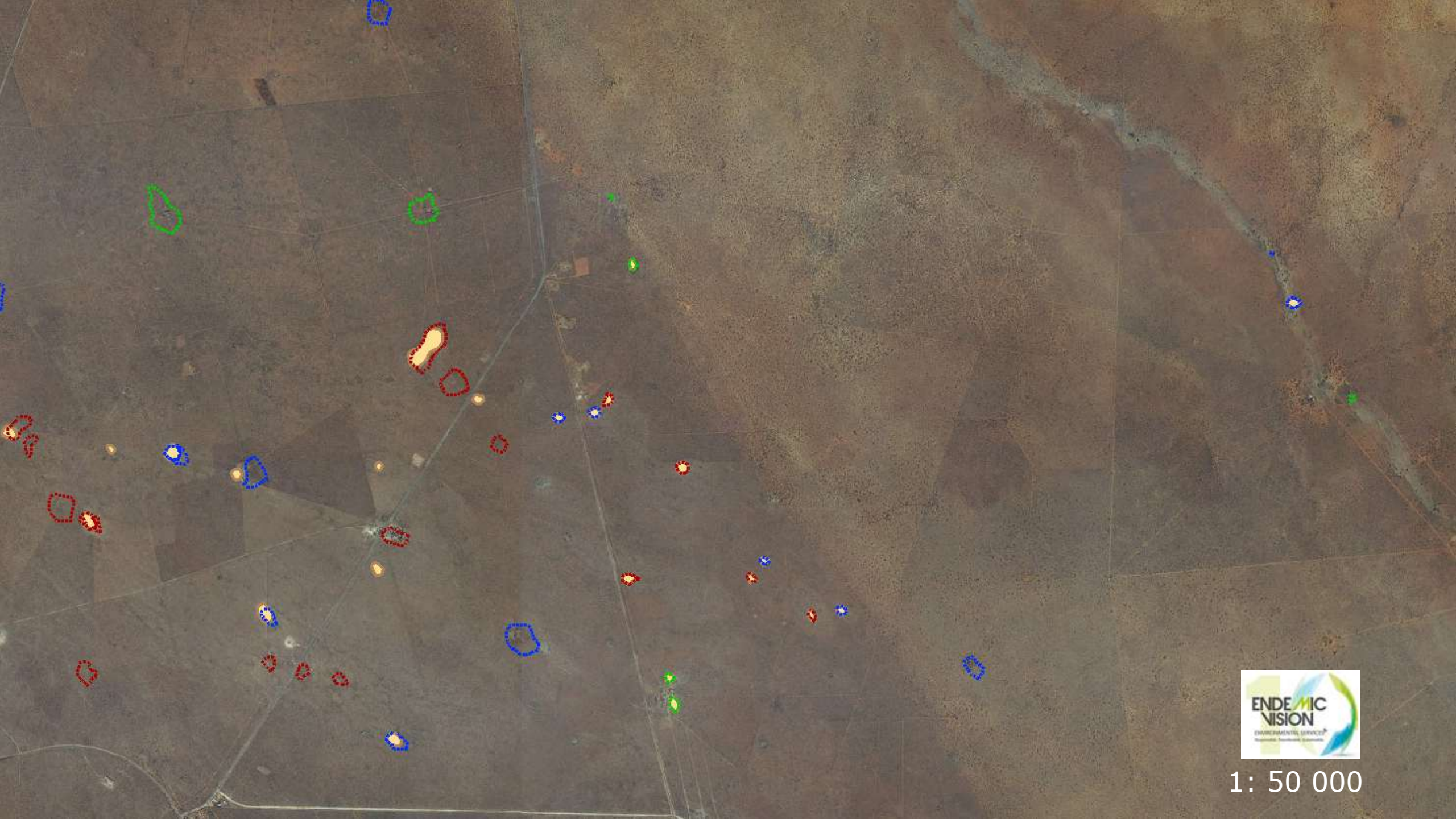


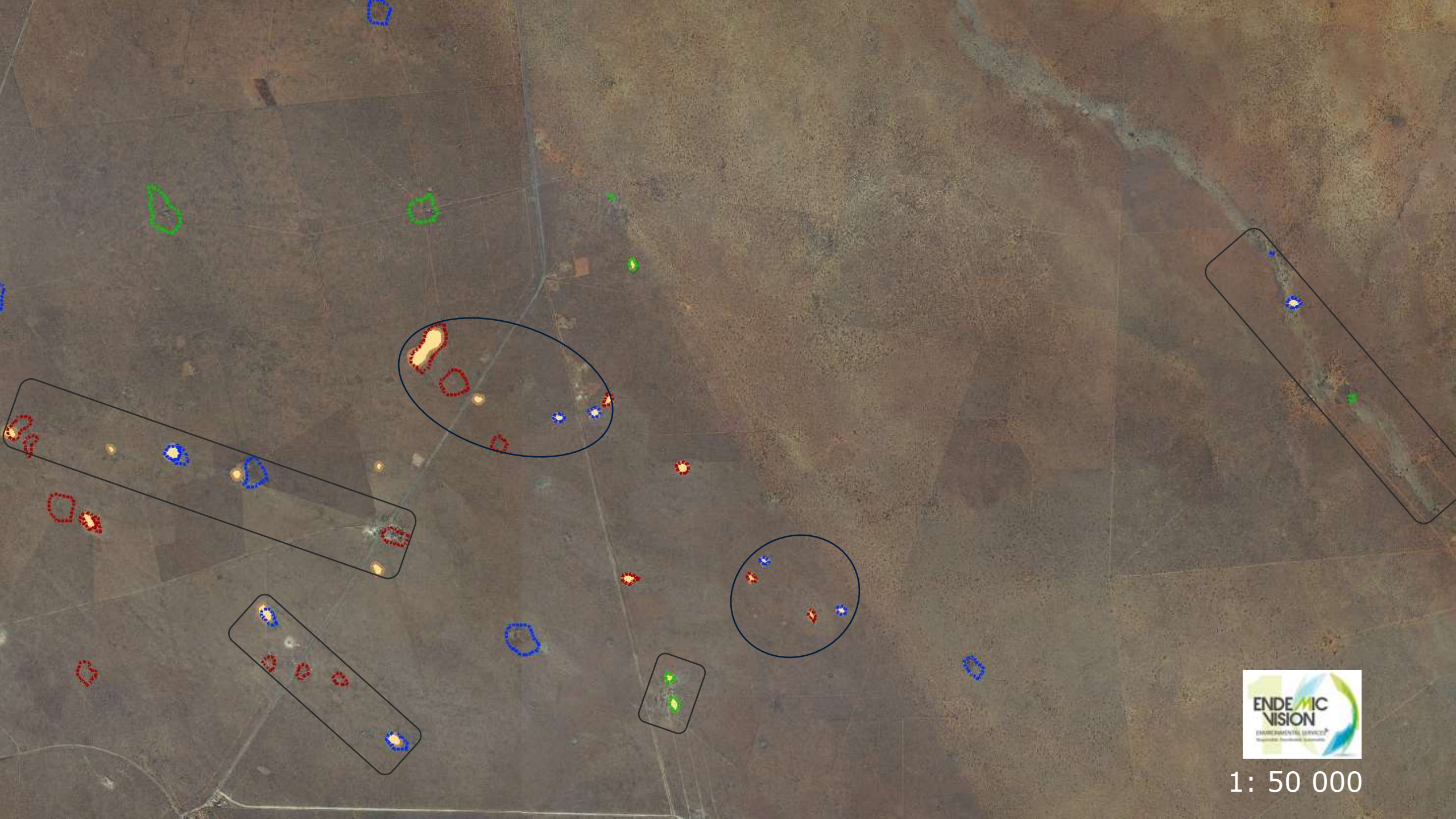
Ephemeral pans





1: 50 000







Ephemeral Pans are honeycomb-like conglomerates of interconnected aquatic linkages

Responsible. Transferable. Sustainable.



Today

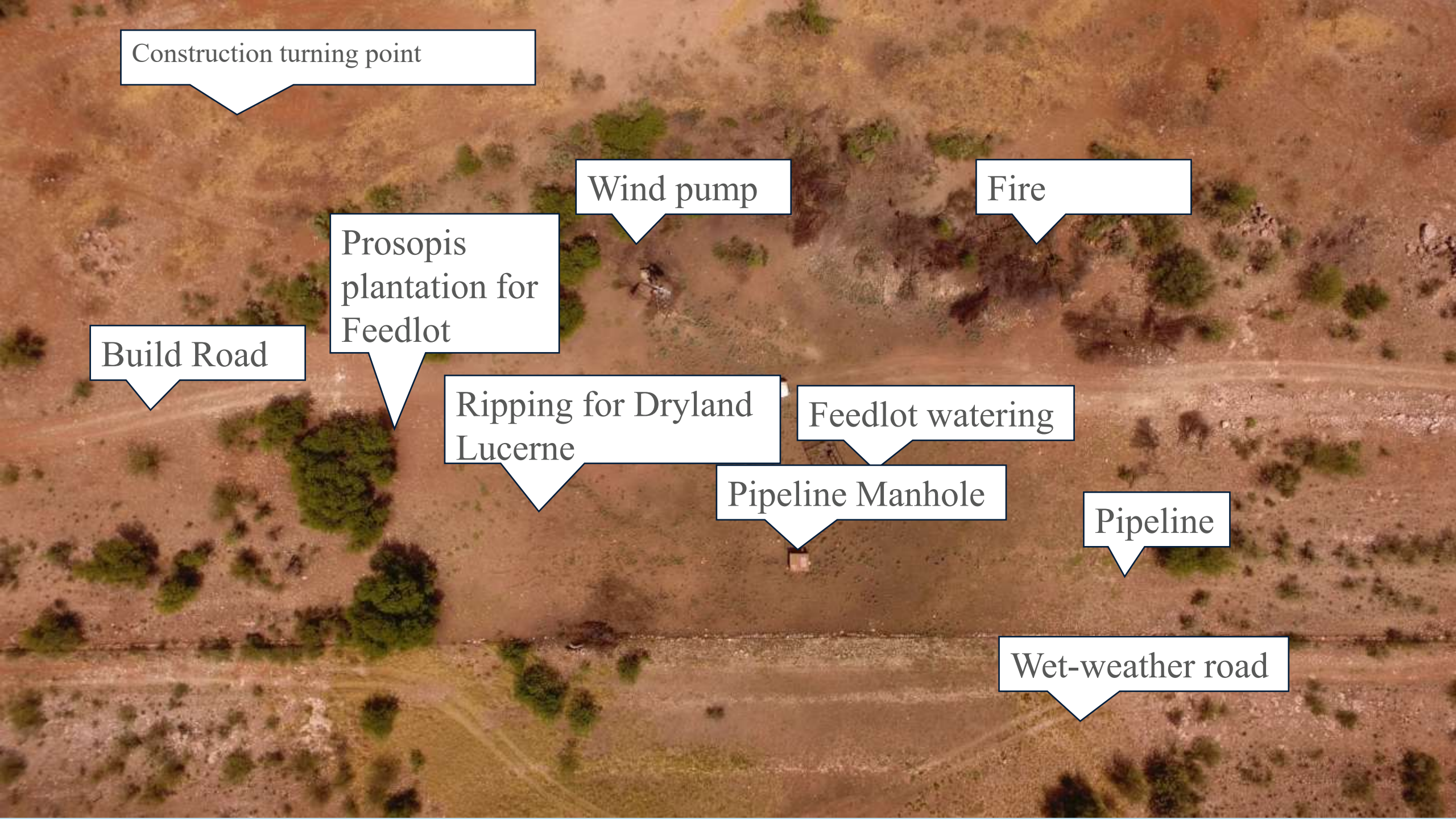
2021 Exceptional Rainfall Year



Ephemeral pans emerge sporadically across arid to hyper-arid landscapes, capturing and retaining water during rare rainfall events, feeding the aquifer lifelines

**When filled with water, they
provide an explosion of
nutrients and cyclical highs for
wildlife, migratory birds and
aquatic organisms.**

**This cyclical process highlights the
delicate balance of life that thrives
in these unusual yet vital
landscapes.**



Construction turning point

Wind pump

Fire

Prosopis
plantation for
Feedlot

Build Road

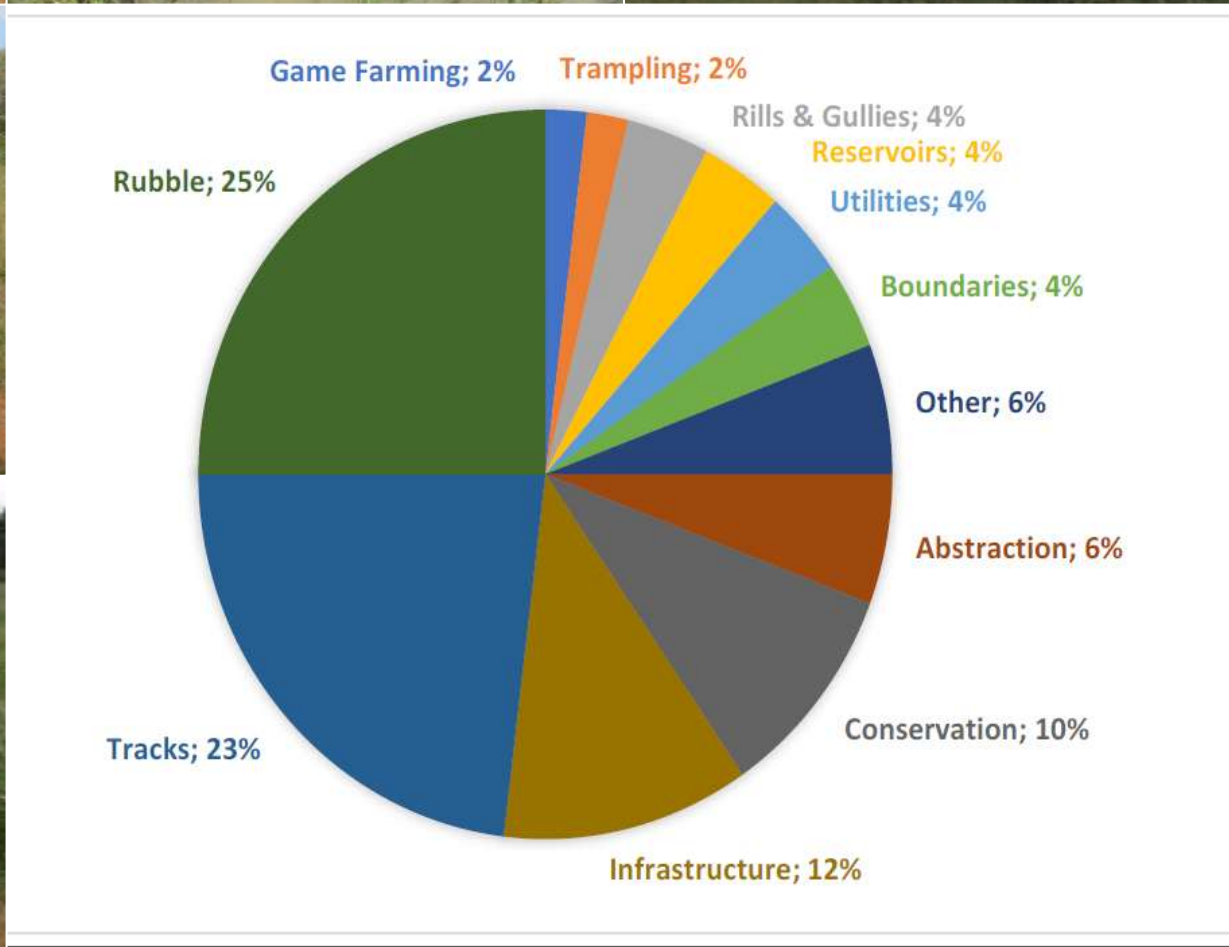
Ripping for Dryland
Lucerne

Feedlot watering

Pipeline Manhole

Pipeline

Wet-weather road



Delineation and Assessing Impacts

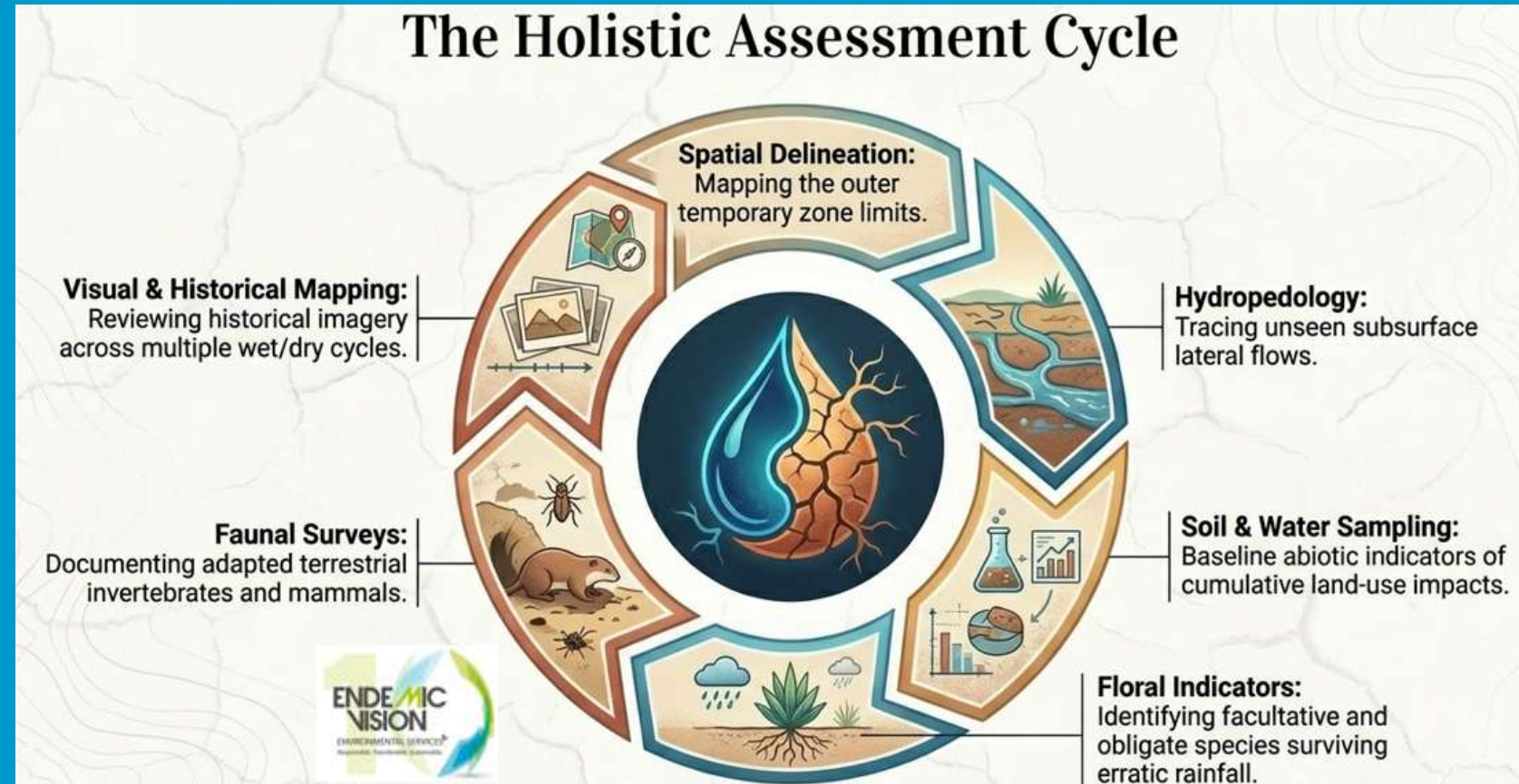


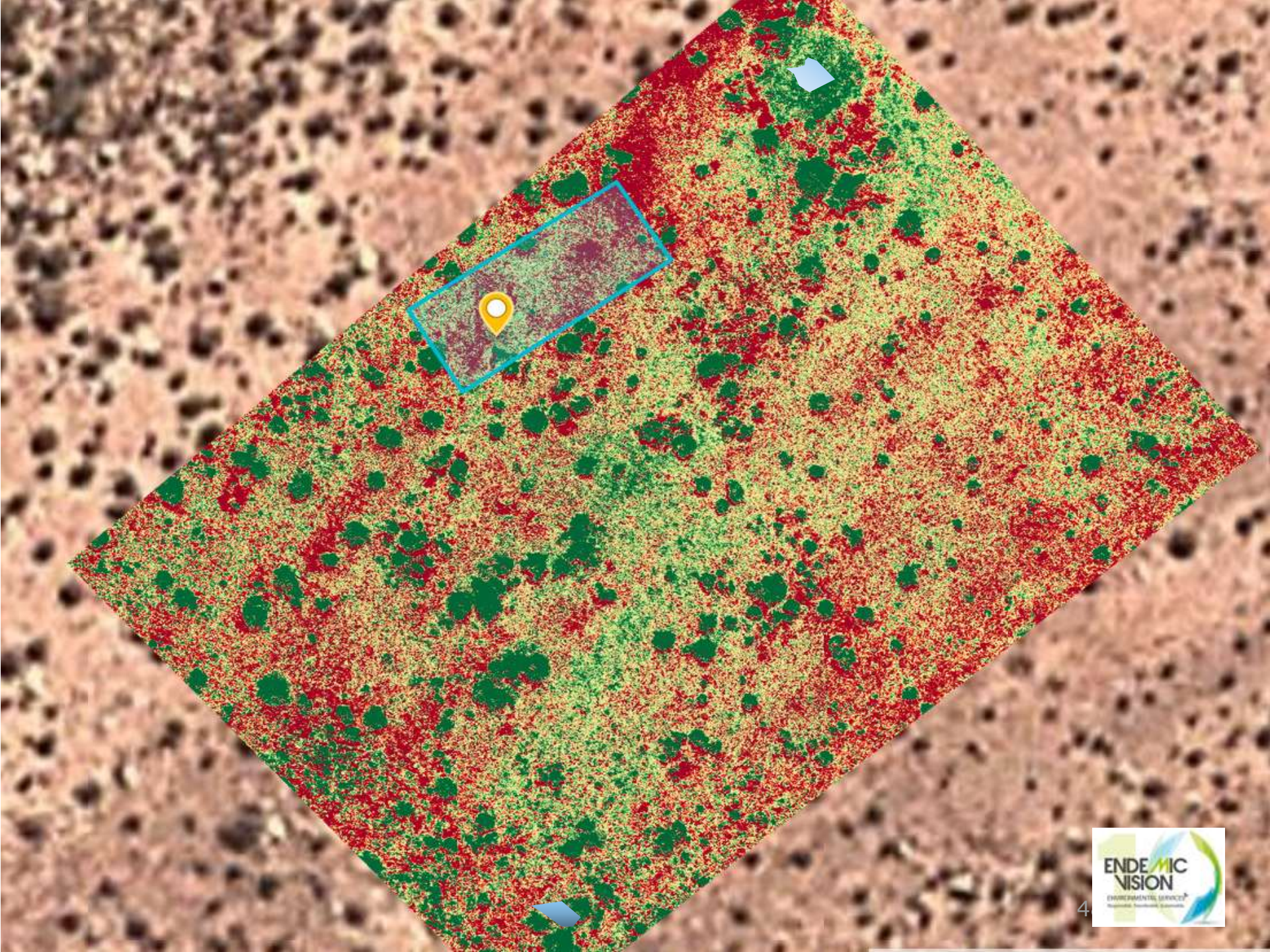
Ephemeral pans are indispensable to anthropogenic co-dependencies on the land

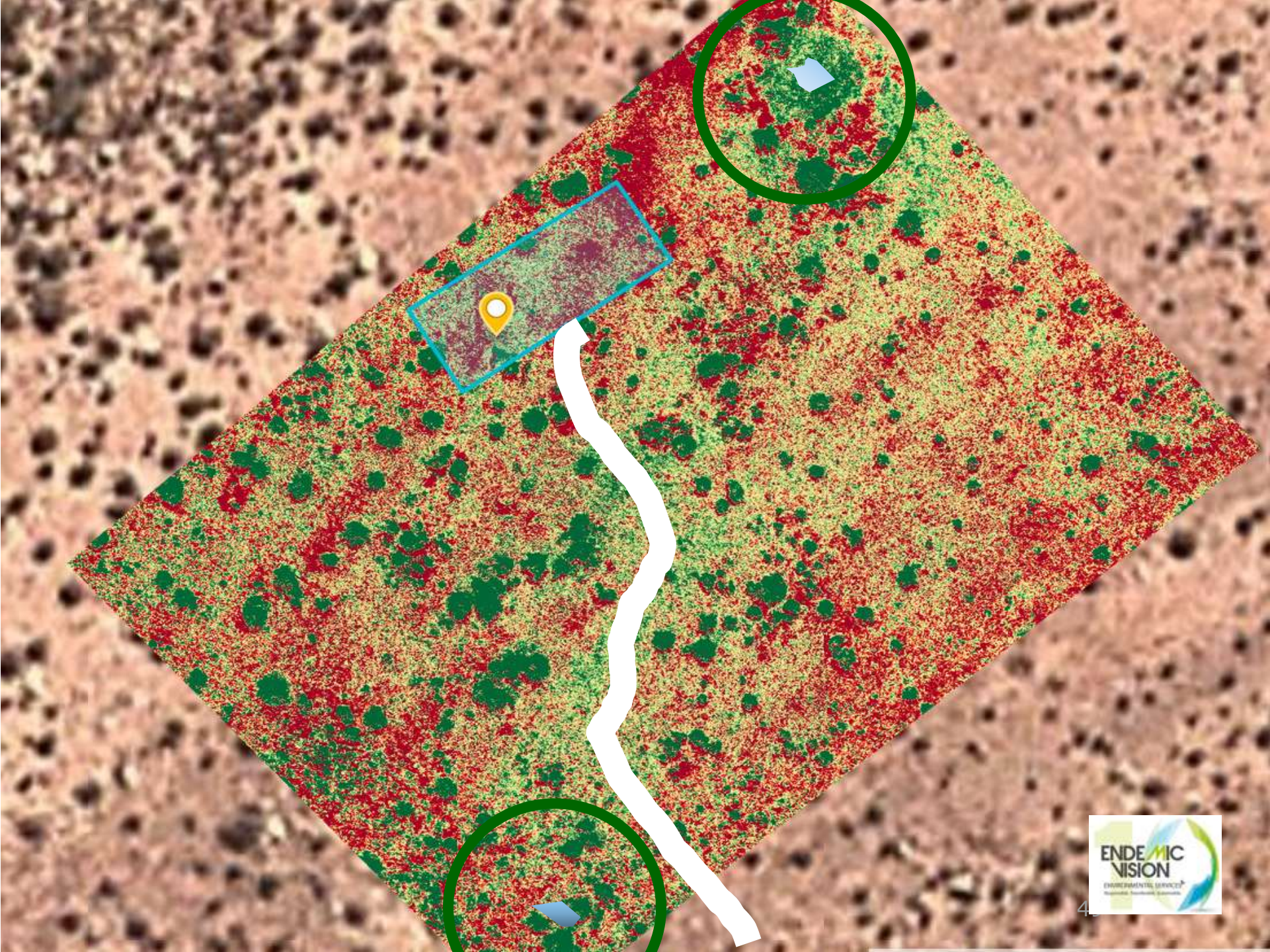
ENVIRONMENTAL SERVICES
Responsible. Transferable. Sustainable.

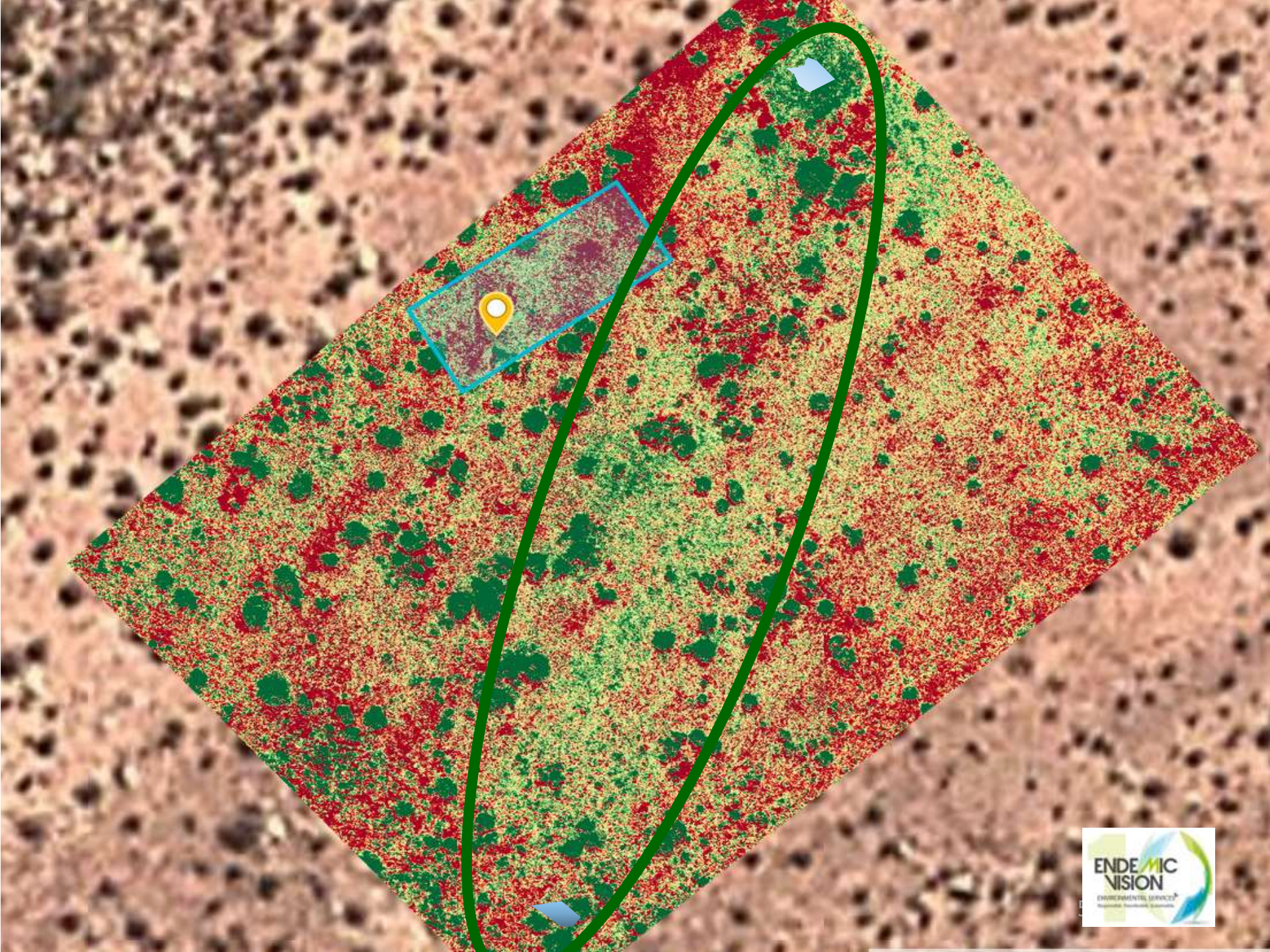
Assessing the individual Pan

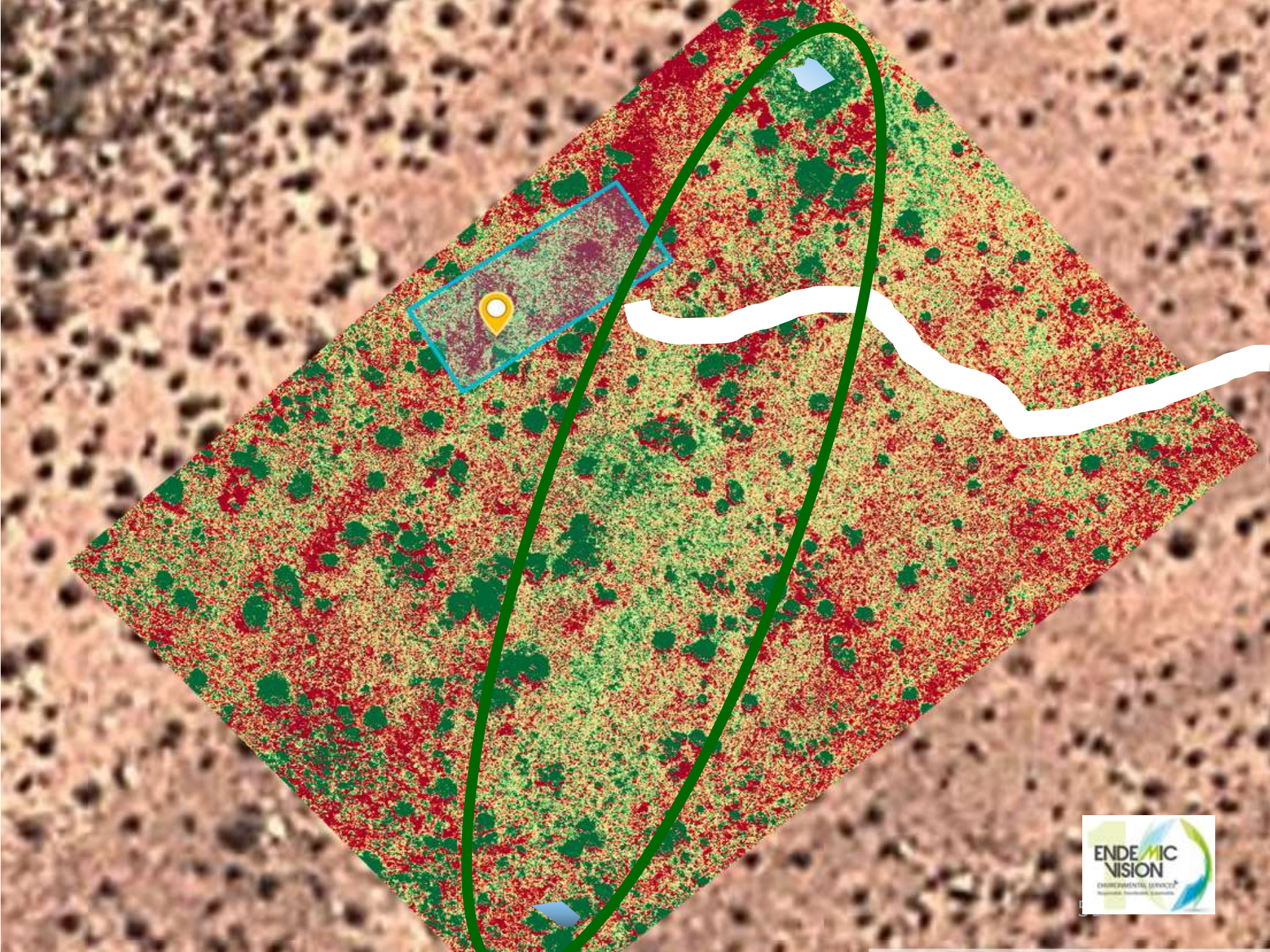
- 👉 Wetland Classification
- 👉 National & Local Importance
- 👉 Delineation
- 👉 Present Ecological State
- 👉 Functional Analysis
- 👉 Ecological Importance & Sensitivity Rating
- 👉 Vegetation Community
- 👉 Soil Characteristics
- 👉 Aquatic Invertebrates
- 👉 Faunal Interactions

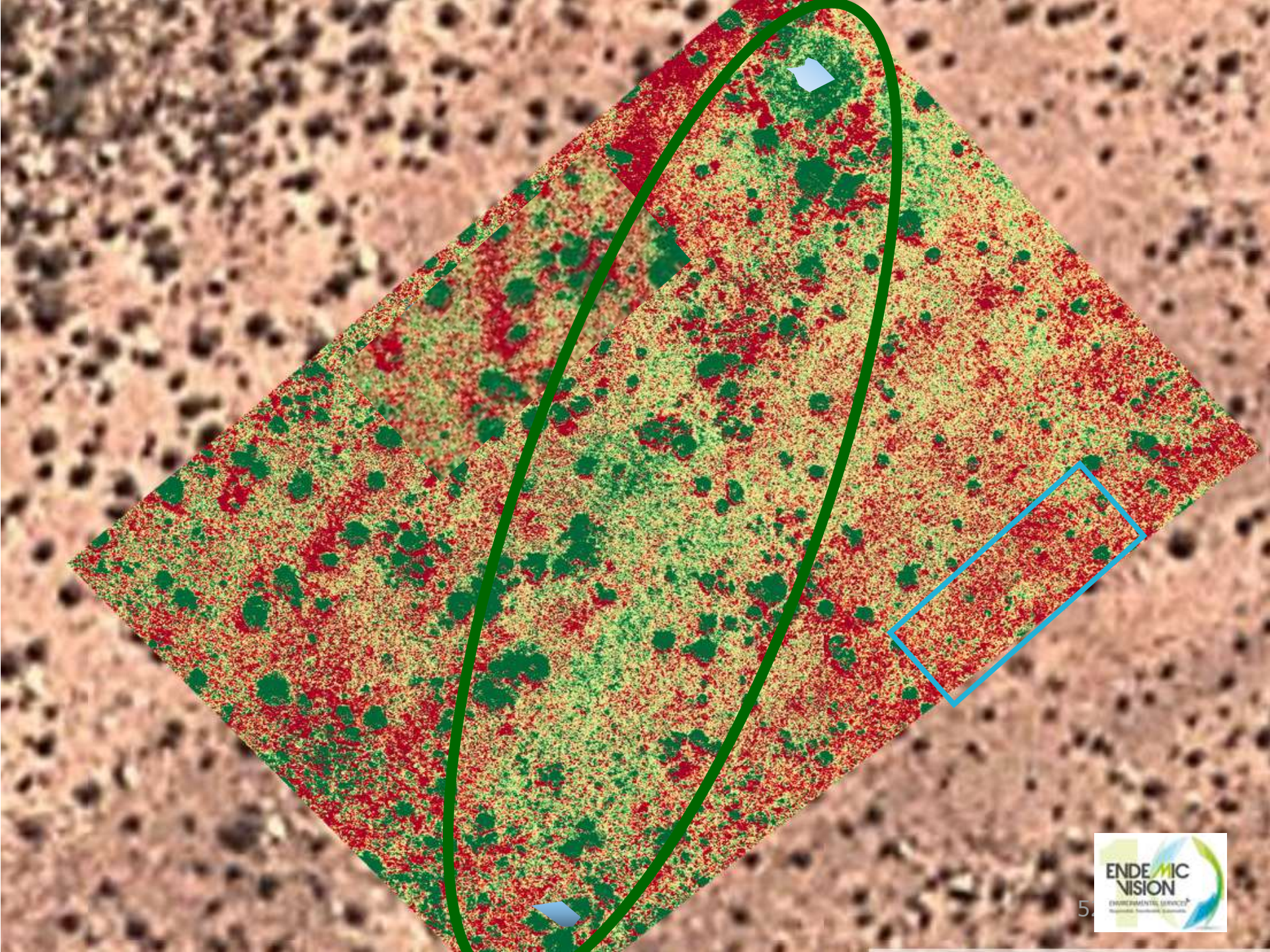








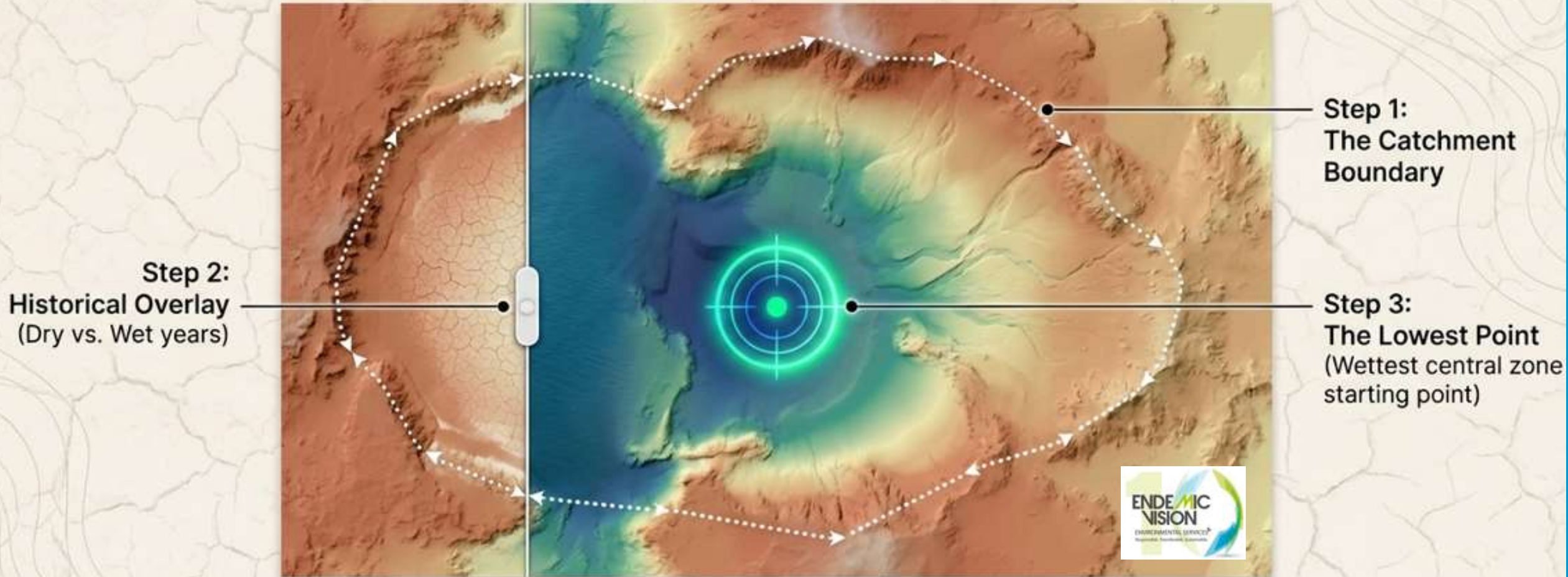




Ephemeral pan clusters are chains of landscape ecological processes and faunal activity

ENVIRONMENTAL SERVICES
Responsible. Transferable. Sustainable.

Delineation Phase 1: Desktop Mapping & Catchment Baselines



**Delineation cannot rely on water presence.
It relies on topography and history.**

Delineation Phase 2: Ground-Truthing the Edge

The Vegetation Transition:
Shift from Obligate/Facultative wetland species to upland terrestrial flora.



The Soil Evidence (Top 50cm):
Redoxymorphic features prove prolonged, historical saturation.



The Boundary Marker:
This is the legally protected Temporary Zone Edge.



Legend

PN

Wetlands

NFEPA wetlands

Valley floor

Delineation

Temporary Zone

Seasonal Zone

Historic

2014

Temporary Zone
2014

Seasonal Zone
2014



NFEPA Wetlands

 Bench

PGIS

 Dry Pan

Fine Scale

 Pans

2025

 Temporary Zone

 Transition Zone

 Seasonal Zone

2020

 Temporary Zone

 Seasonal Zone

Kalahari Ephemeral Pans are different

- 👉 Small functional centres that are seasonally active
- 👉 Pans are very dynamic (size, shape, location)
- 👉 Pan extent and centre $\neq$ correlation
- 👉 NFEPA correlation for Kalahari pans is poor.
- 👉 In-depth assessment of pans is always required.
- 👉 Residual pan areas are still highly diverse (relic ecotone).
- 👉 Delineation must note the fragmentation of mega-community interactions between pans (corridors)

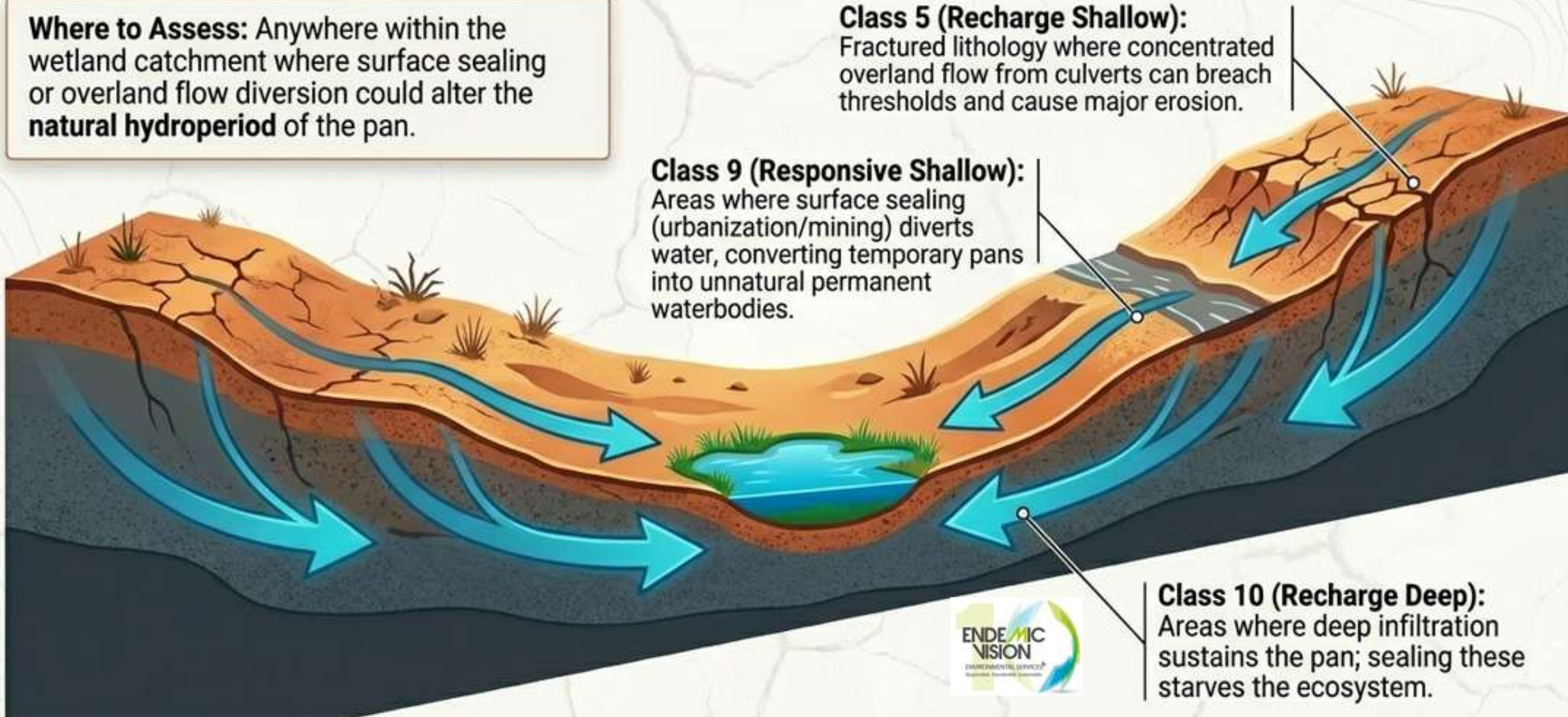
Subsurface Lifelines: Triggers for Hydropedological Assessment

Where to Assess: Anywhere within the wetland catchment where surface sealing or overland flow diversion could alter the **natural hydroperiod** of the pan.

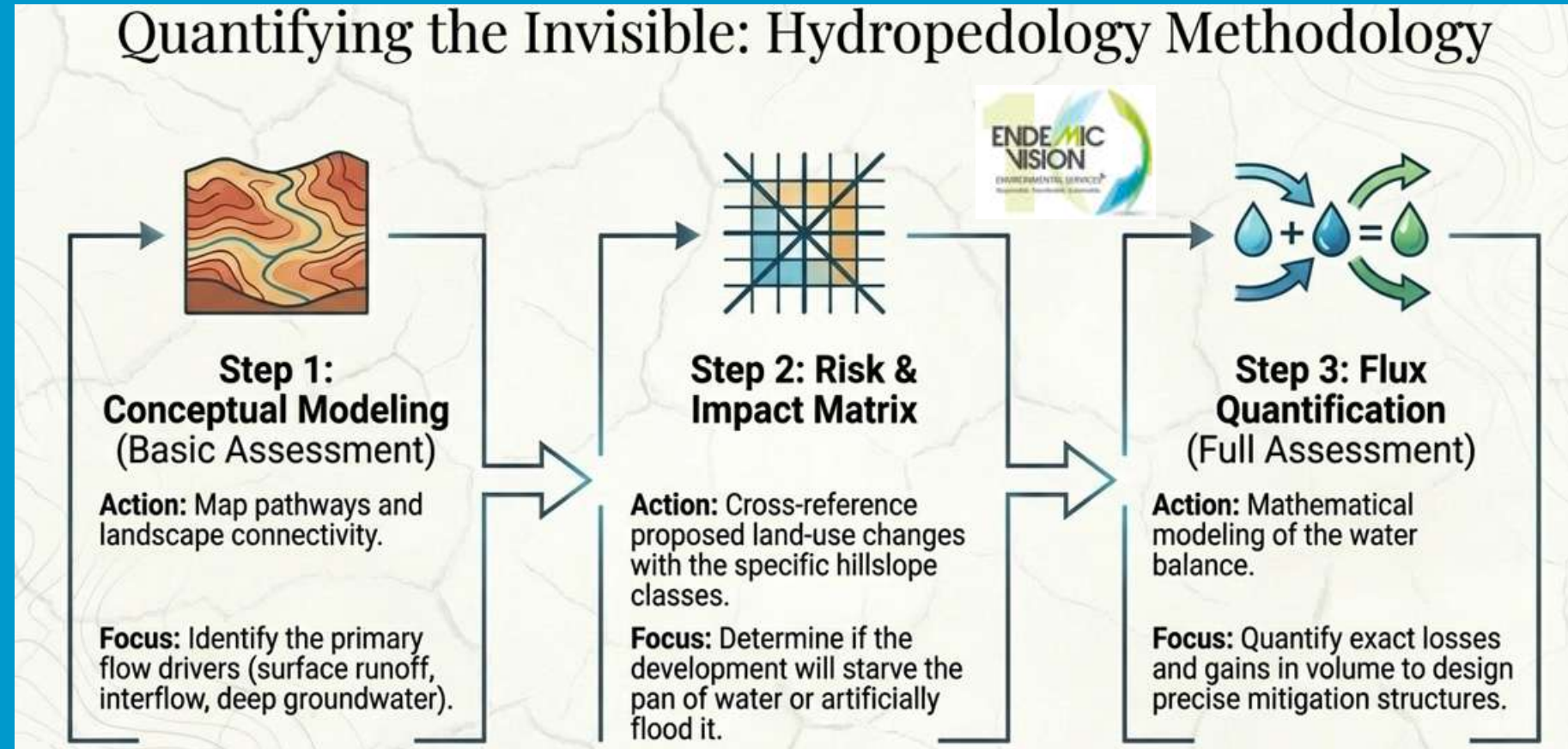
Class 5 (Recharge Shallow):
Fractured lithology where concentrated overland flow from culverts can breach thresholds and cause major erosion.

Class 9 (Responsive Shallow):
Areas where surface sealing (urbanization/mining) diverts water, converting temporary pans into unnatural permanent waterbodies.

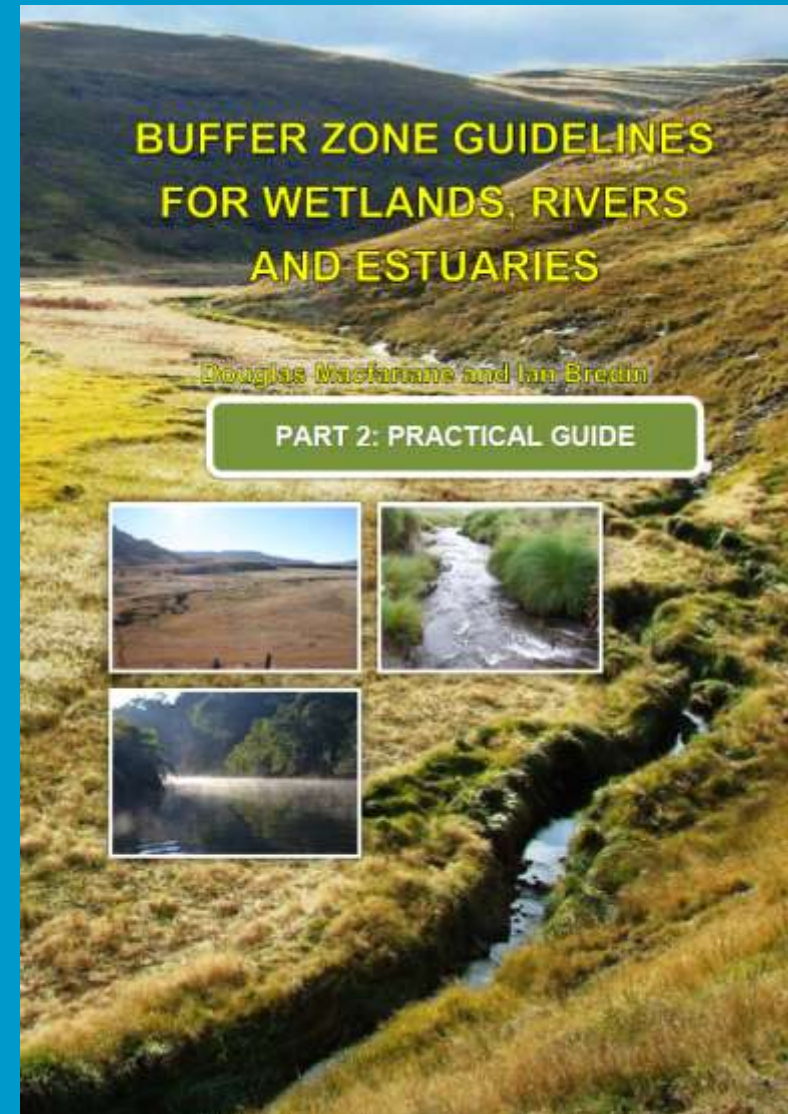
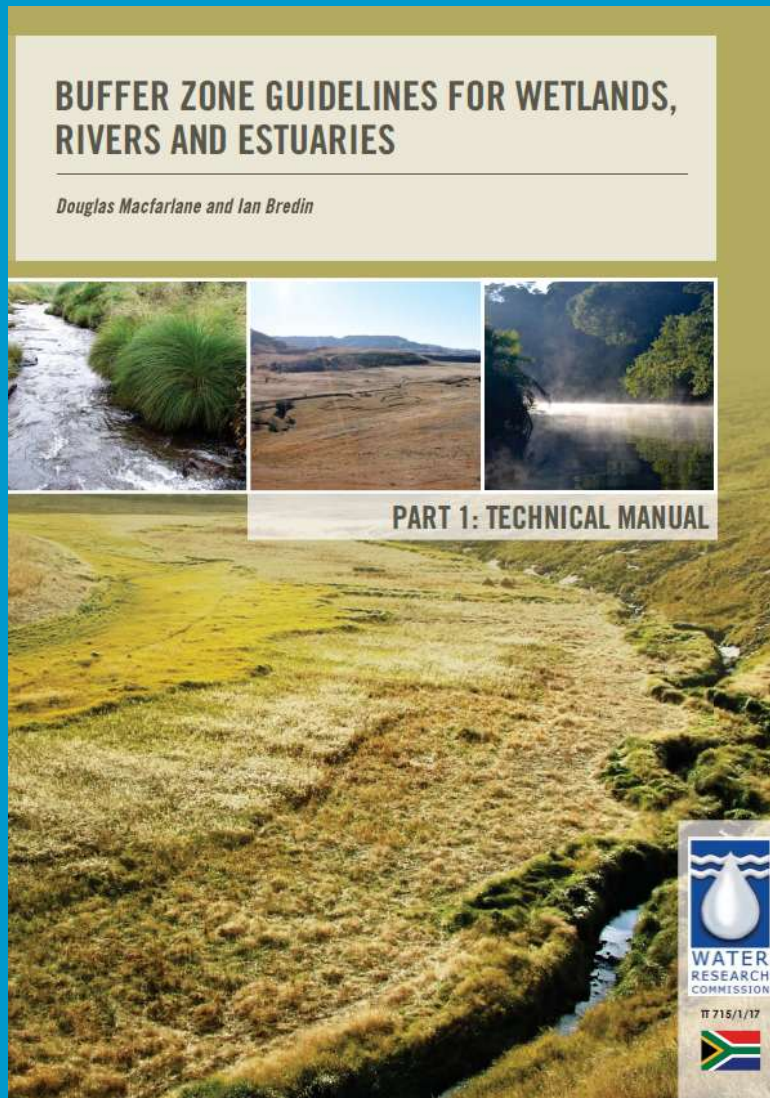
Class 10 (Recharge Deep):
Areas where deep infiltration sustains the pan; sealing these starves the ecosystem.



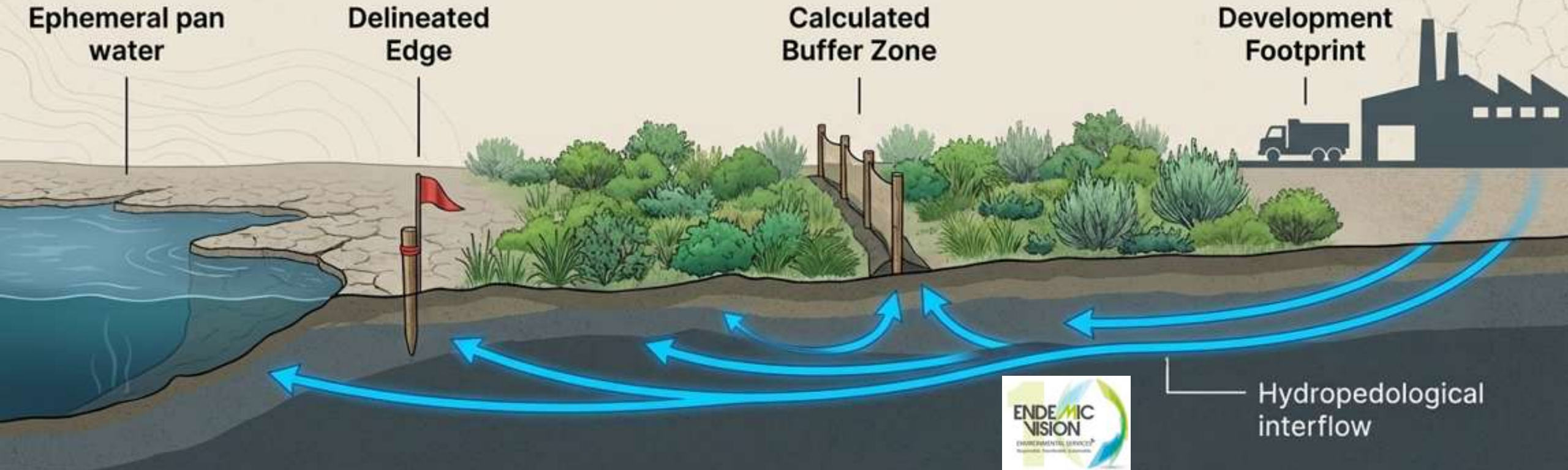
Hydropedological Assessments



Determining buffer zones



Demarcation: Drawing the Line in the Sand



The line on a map must be a 'Pulse of the Pan'
The line on a map must become reality on the ground.
Demarcation prior to construction is non-negotiable.

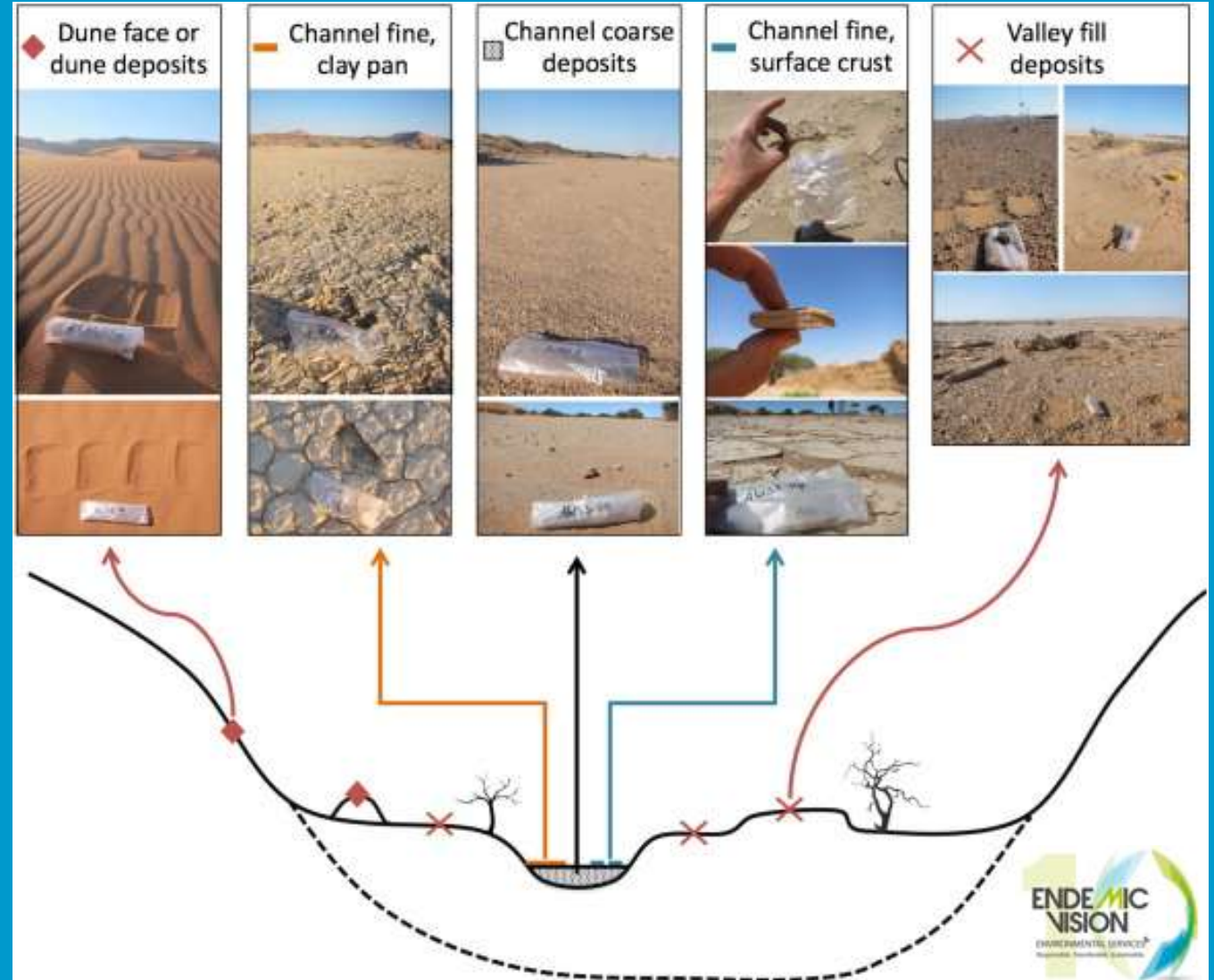
Soil Assessments

- Profile Auguring
- Soil sampling and chemical analysis
- Soil texture and structure infield hand tests



Soils

- 👉 Indicate catchment health for major impacts (chemical contrasts in landscape over time)
- 👉 Calcium outlier chemical (0.9) in all Kalahari pans
- 👉 Poor correlation between pan extent and mineral concentration
- 👉 Artificial pans: significantly higher pH and EC and least N & C, regardless of size.



Vegetative Indicators

Species diversity

Vegetation Heterogeneity

Indicator species

Alien species

Protected species

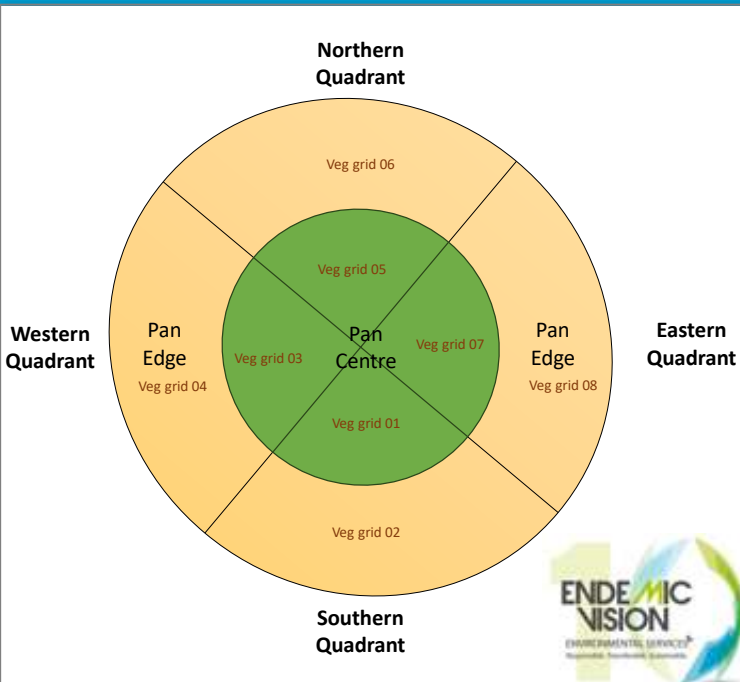
Climax species

Obligate species

Preferential Species

Facultative Species

Terrestrial Species



Wetland Flora: The Hierarchy of Riparian Dependency

Flora is classified into four distinct categories based on their loyalty to riparian and wetland environments, identifying species by their probability of occurrence in wet zones and physiological response to environmental changes.

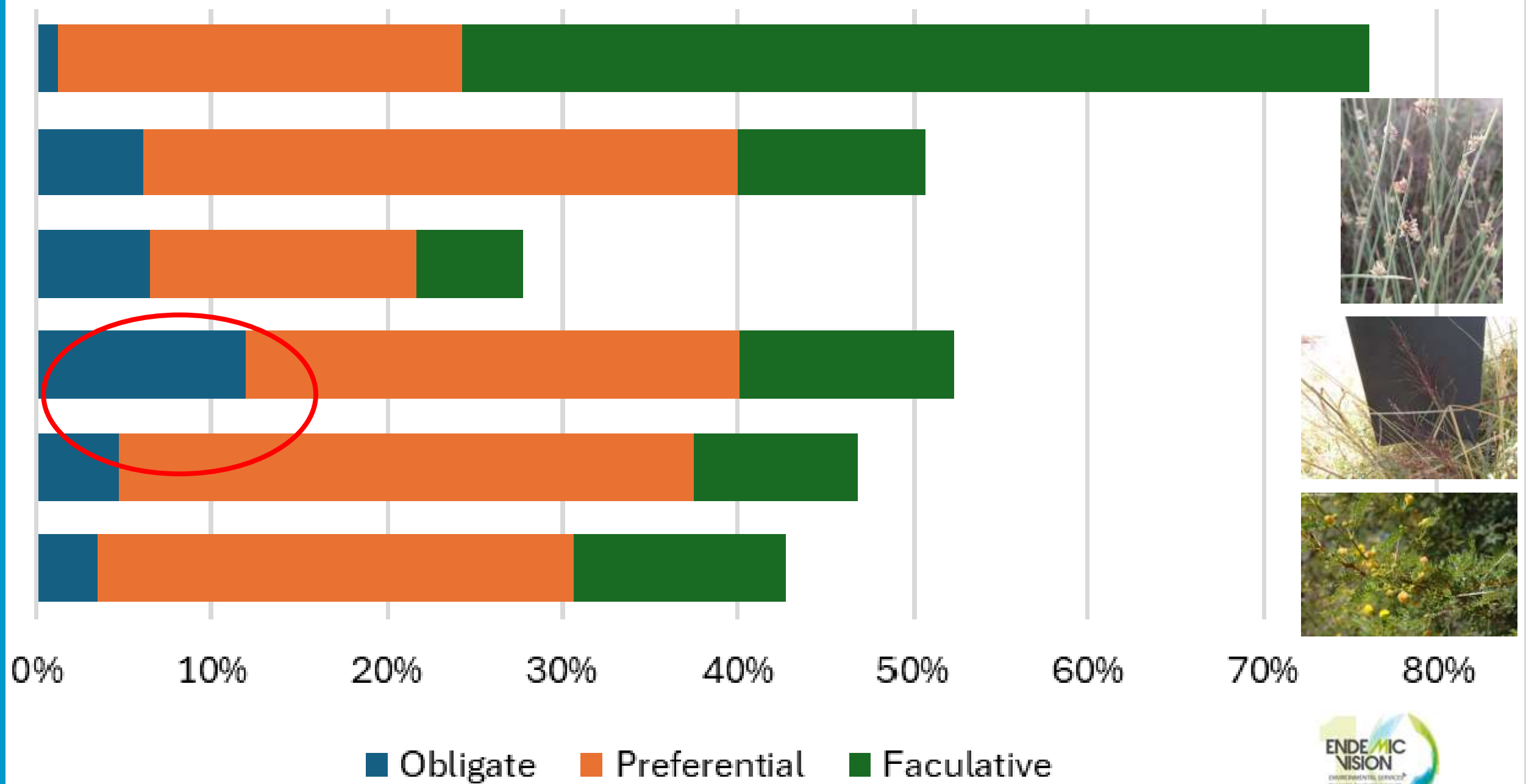


Vegetation Community

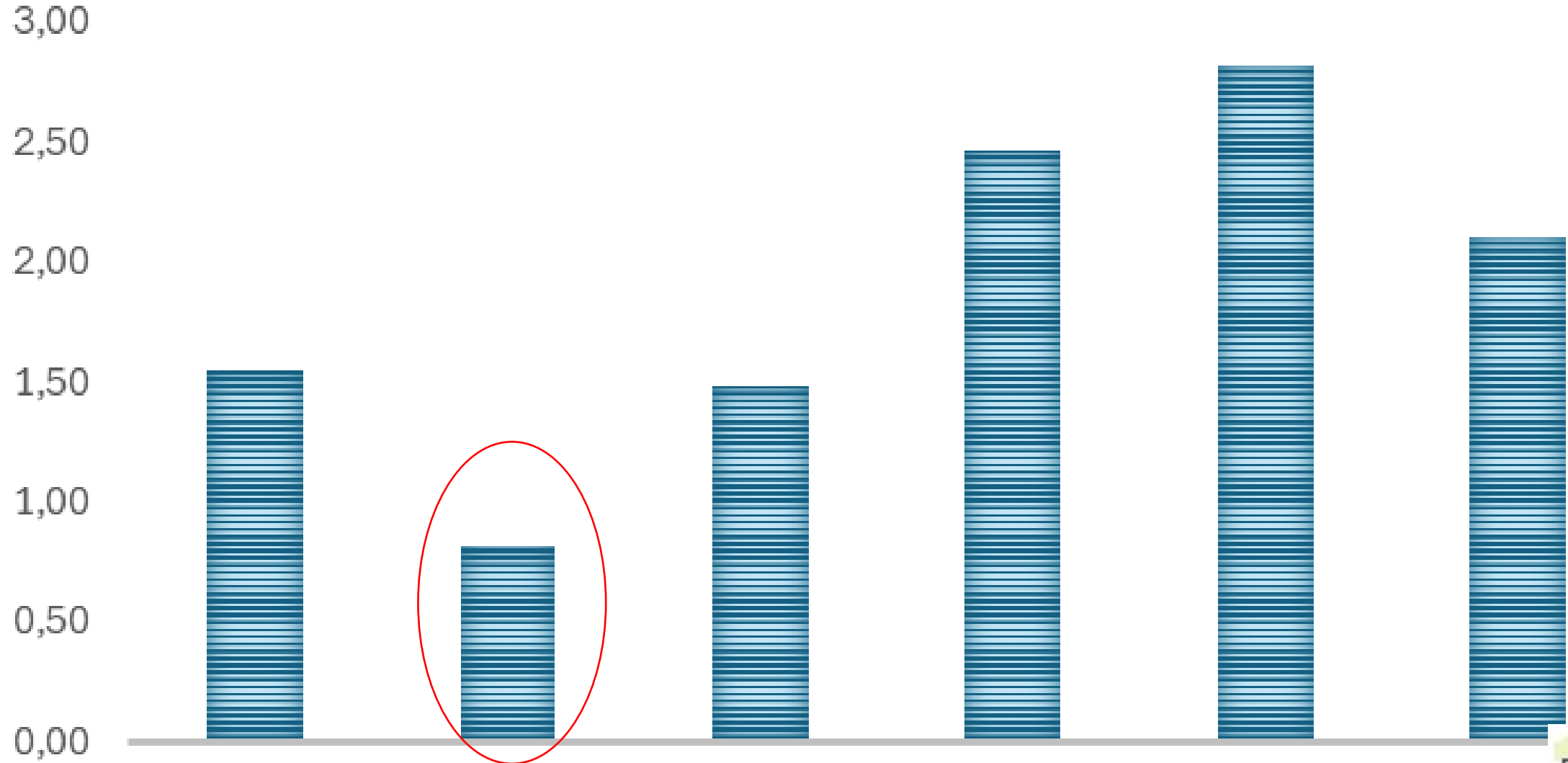
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156 plant species of 364
Of which 27 is unique to pans



BETA DIVERSITY



Ecological Condition and Ecosystem Services Methodology



Assessment Category	Application success	#
flood attenuation	good application	
erosion control	good application	
maintenance of biodiversity	good application	
sediment & phosphate trapping	good if evaporation & dust	
stream flow regulation	limited application	
natural resources	limited application	
research	some application	
carbon storage	poor application	
water supply for human use	poor application	
cultivated foods	poor application	
cultural significance	poor application	
tourism	poor application	
recreation	poor application	
education	poor application	
nitrate & toxicant removal	not applicable in most instances	

Aquatic Invertebrate Activation



BIODIVERSITY MAINTENANCE IS THE PRIMARY BENEFIT

All pans are rated moderately high
for providing unique habitats
in an arid landscape.



Fairy Shrimp



**Specialized Habitats for Unique
Species.** Pans support rare aquatic
invertebrates like fairy shrimp that
survive long dry periods.

The assessment of
temporary wetlands during
dry conditions
(Day *et al.*, 2010)





ENVIRONMENTAL DNA (eDNA)

- Animals shed cells containing DNA as they move (skin, mucous, faeces, urine) through environments
- Cells with DNA enters water courses
- This is environmental DNA (eDNA)
- eDNA in the water remains detectable for hours to few days
- The eDNA can be captured & used to survey species



IUCN listed species



Platanna



Freshwater crab



Flat back toad



Mountain Tortoise



Longfin tilapia

IUCN listed species - Birds



European Roller



Redwing Francolin



Shelleyi francolin



Common Shell duck



Night Heron

IUCN listed species - Mammals



Pangolin



Striped polecat



Cape Serotine bat



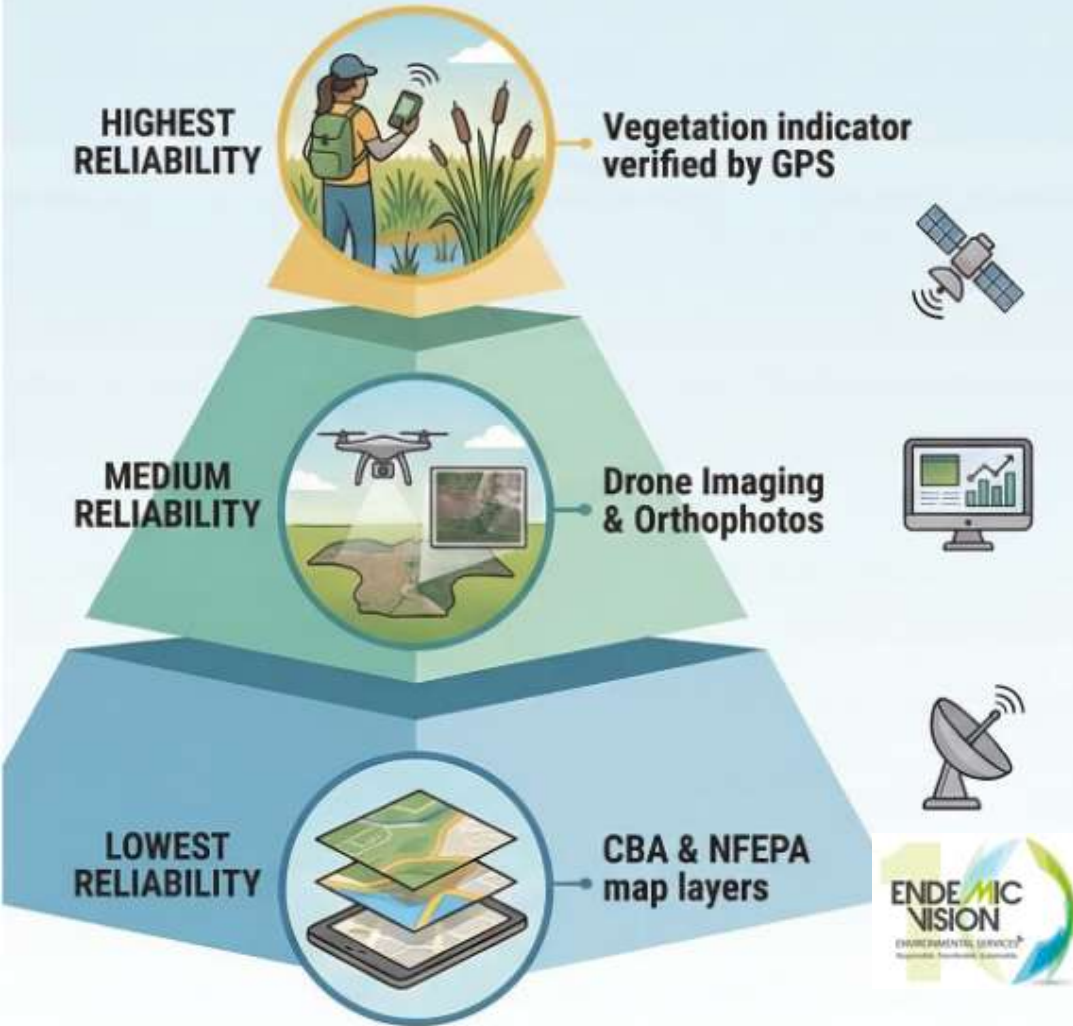
Bushveld Gerbil

**Ephemeral pans in
themselves are critical
diversity refugia
that supports diverse flora
and fauna, offering vital
resources in an otherwise
inhospitable environment.**

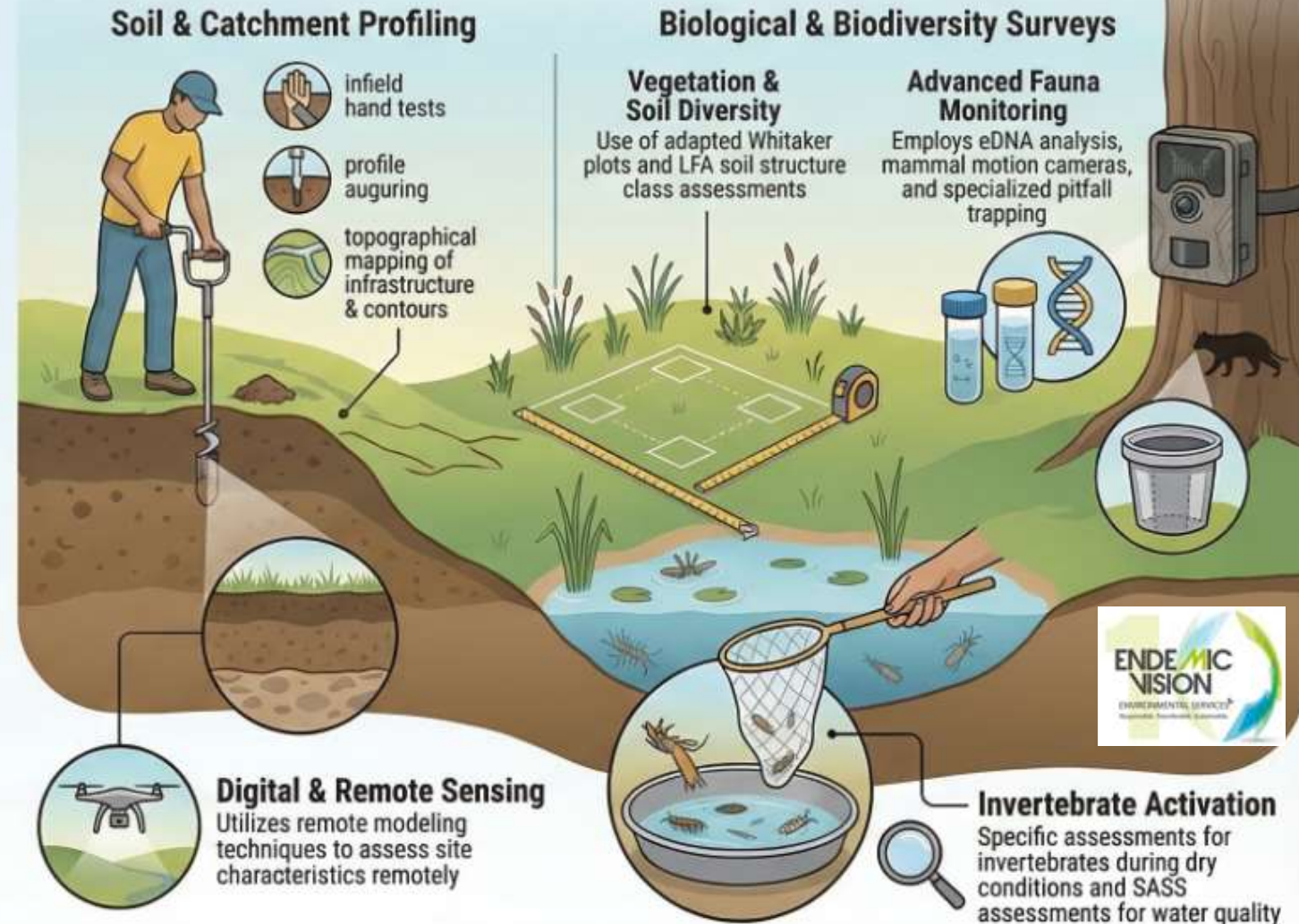


Ephemeral Pan Assessment: The Professional Toolkit

Delineation Reliability Ladder



Physical & Biological Assessments



Conclusion



Add site experience to knowledge as early as possible



Delineation, Buffering, Impact and Alternatives must be completed in the context of the landscape



Confirm tools with the client before quoting



Your **reliabilism** will leave enduring legacies and empower everyone to make wiser decisions.

Acknowledgements

- 👤 Water Research Commission (WRC)
- 👤 Department of Water Affairs and Sanitation
- 👤 Penn State College of Agricultural Sciences
- 👤 Wetland Society of Southern Africa
- 👤 NatureMetrics
- 👤 Upstream Consulting
- 👤 Afribugs CC
- 👤 Sishen Iron Ore Company Pty (Ltd)
- 👤 EndemicVision Environmental Services Pty (Ltd)

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