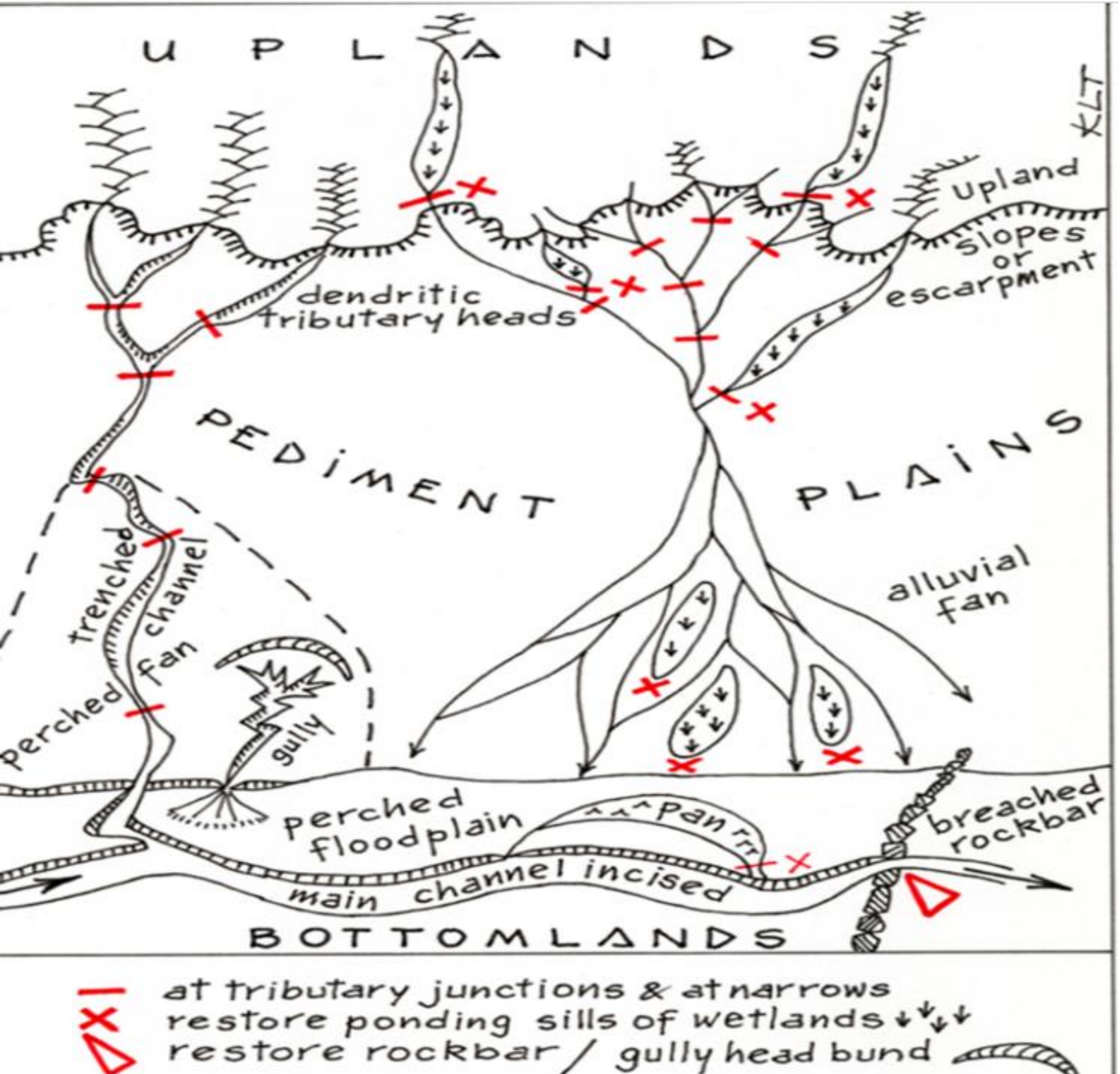
Restoring Natural Catchment Functions of Agricultural Landscapes

Tim Wiley, Tierra Australia Pty Ltd

Redesigning landscapes using Catchment Function Analysis

1. Analyse landscape as **functioning systems**
2. Map how the systems would have **functioned naturally** before clearing
3. Identify where key processes are **disrupted**
4. **Design interventions** to restore natural functions
5. Implement **on ground works**
6. **Monitor, learn & improve**



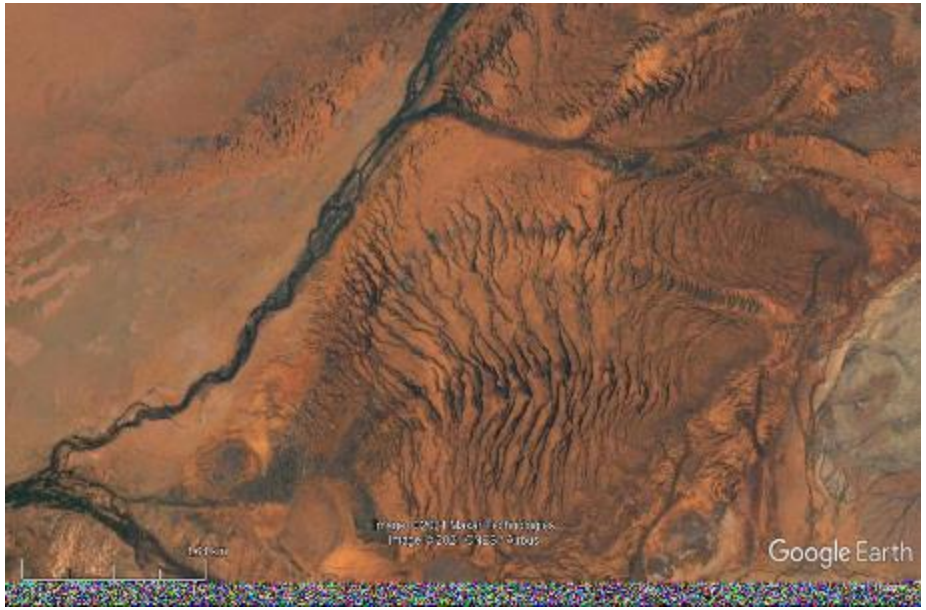
CATCHMENT FUNCTION ANALYSIS

DeGrey River catchment

The principles, process & patterns of how landscapes function

(Ken Tinley & Hugh Pringle)

Patterns of contours high in the landscape built by water, litter & plants

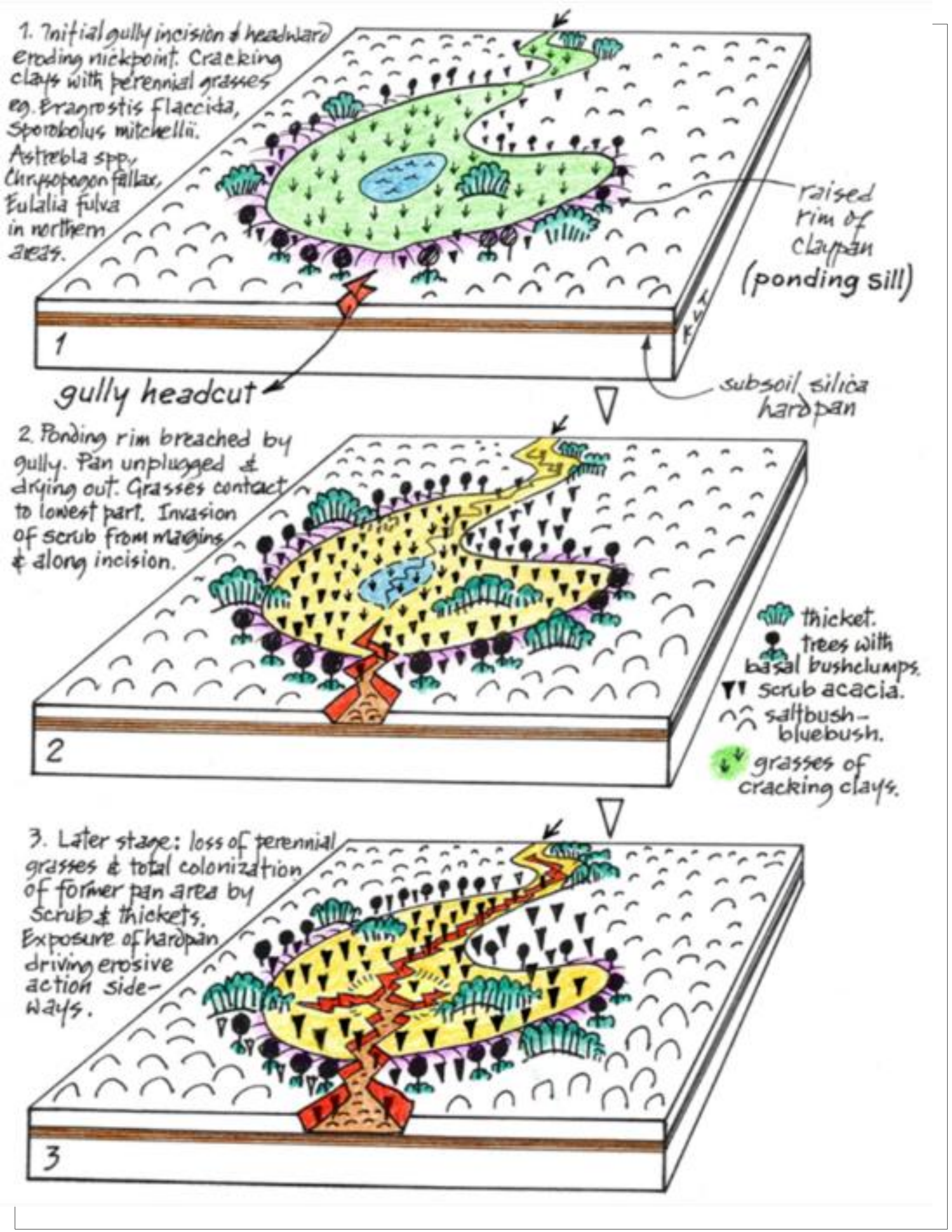


Mt Nameless, Tom Price

Spinifex contours

destroyed by hot fire.

Agricultural contours



DEHYDRATION OF THE ‘CHAIN OF PONDS’

- The natural steps along rivers, and at the bottom of ponds, are breached resulting in

landscape dehydration

- By rebuilding those steps we can hold water higher in the landscape to

landscape rehydration

- Regenerative land management is aimed at rebuilding chains of ponds to restore natural flood plains.
- Mother nature will do most of the work for free

Creek rehydration

Chain of ponds

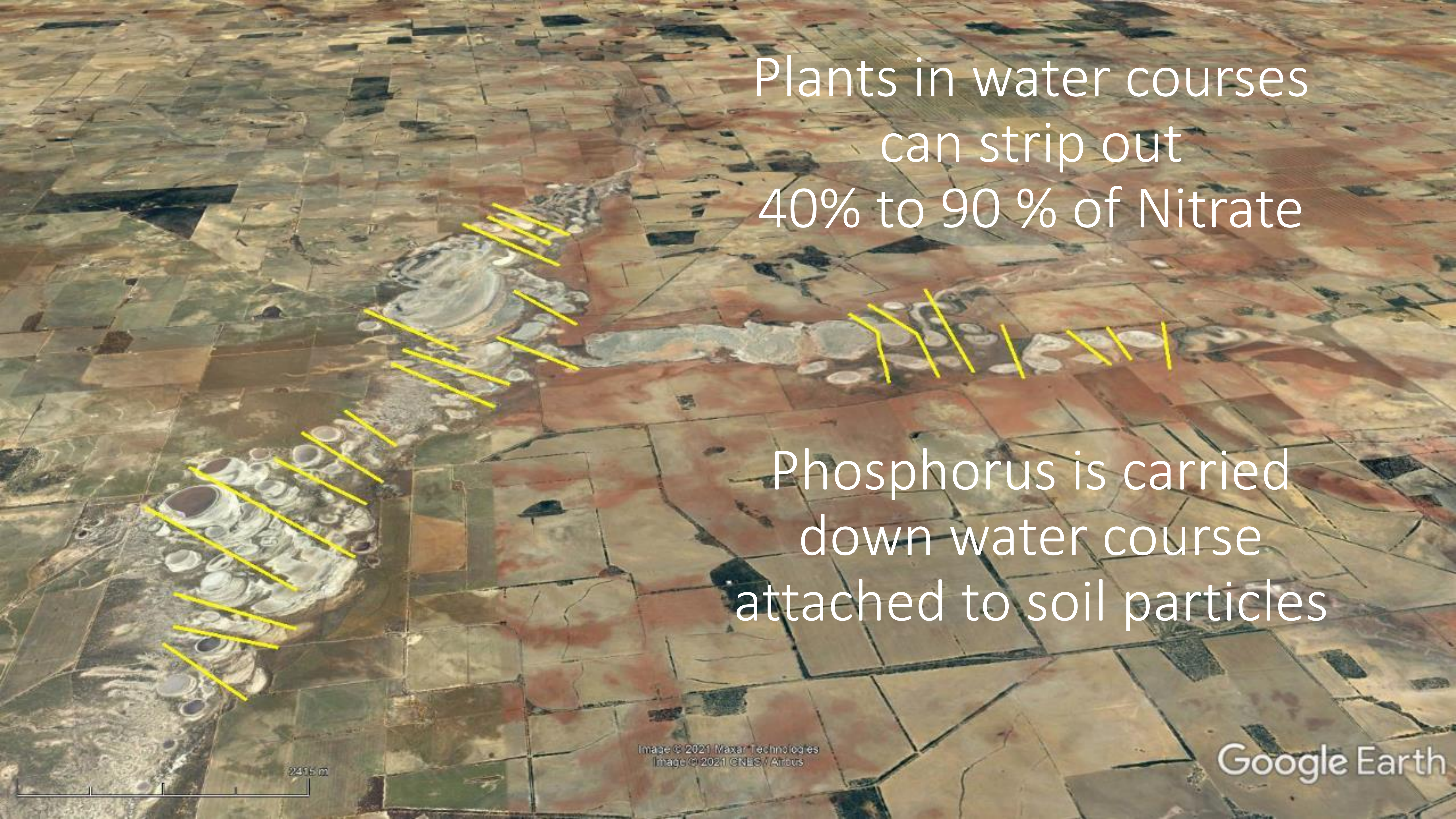
Dandaragan

ROD O’BREE, YANGET FARM
‘THREE CREEKS’ DAM

Before rehydration

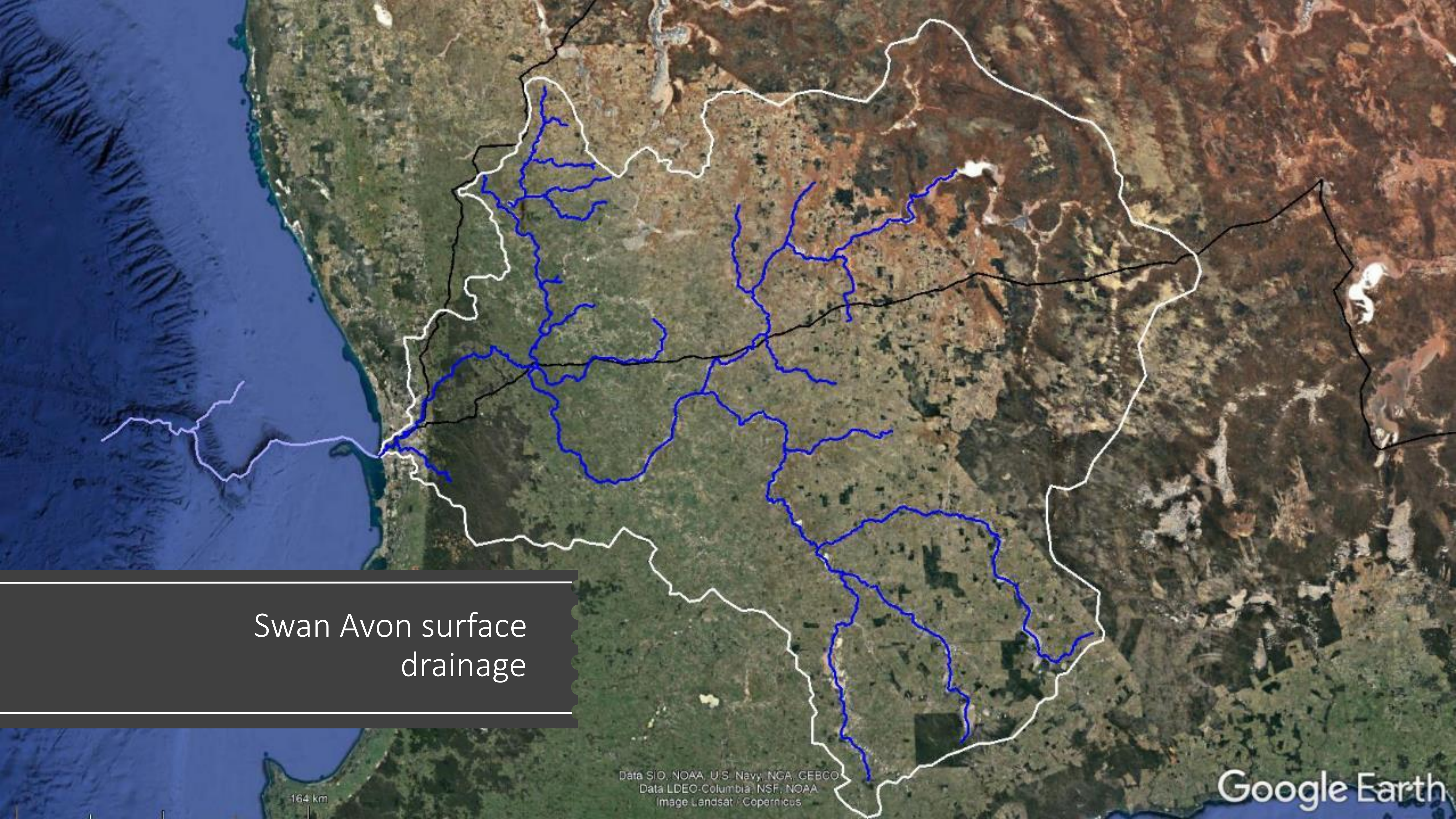
After rehydration works


Chain of ponds
Image © 2021 Maxar Technologies
Image © 2021 CNES / Airbus
2415 m
Google Earth

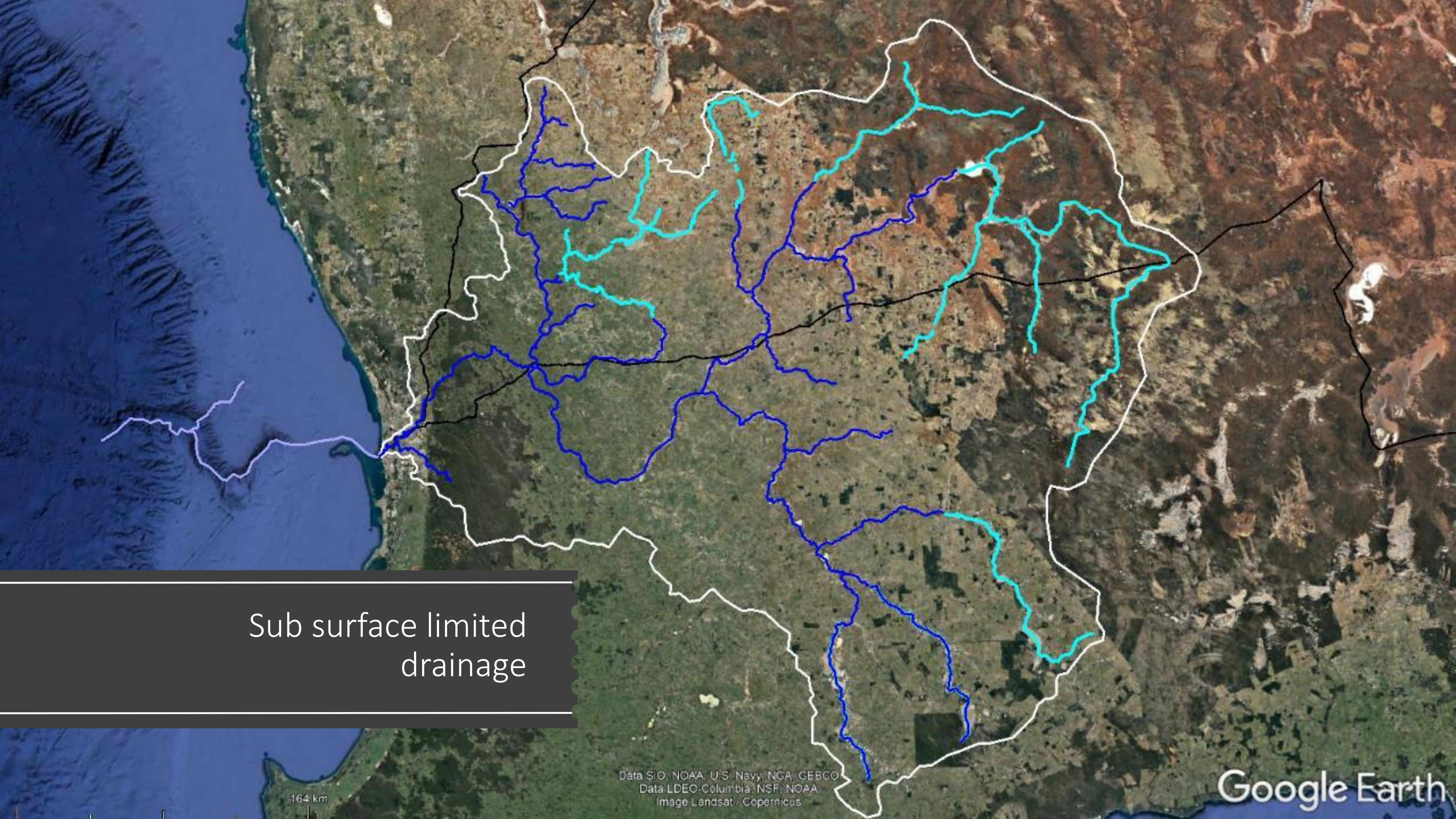

Plants in water courses
can strip out
40% to 90 % of Nitrate
Phosphorus is carried
down water course
attached to soil particles
Image © 2021 Maxar Technologies
Image © 2021 CNES / Airbus
Google Earth

Incised drainage creeks

Swan Avon surface drainage

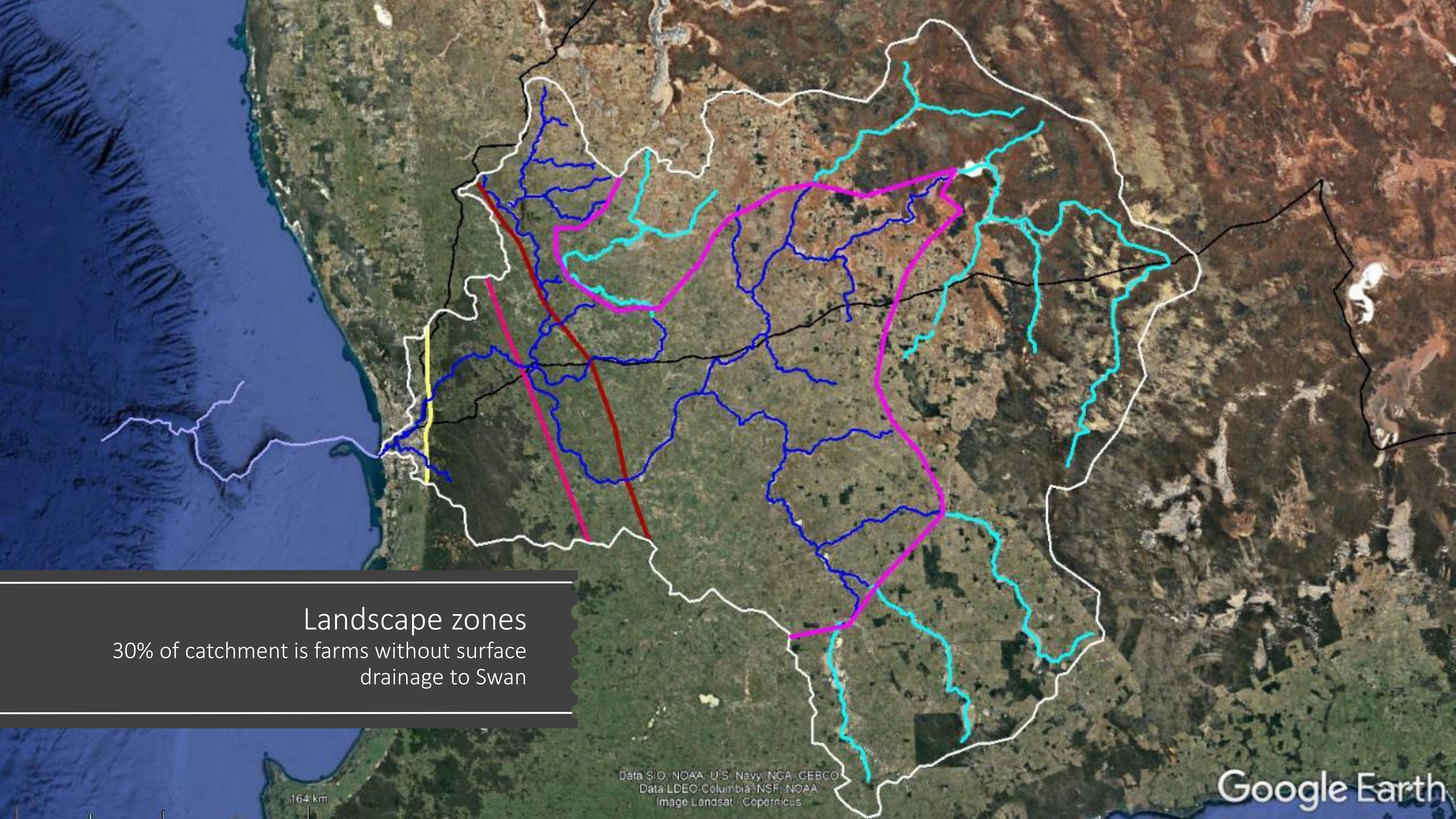


Sub surface limited drainage



Landscape zones

30% of catchment is farms without surface drainage to Swan

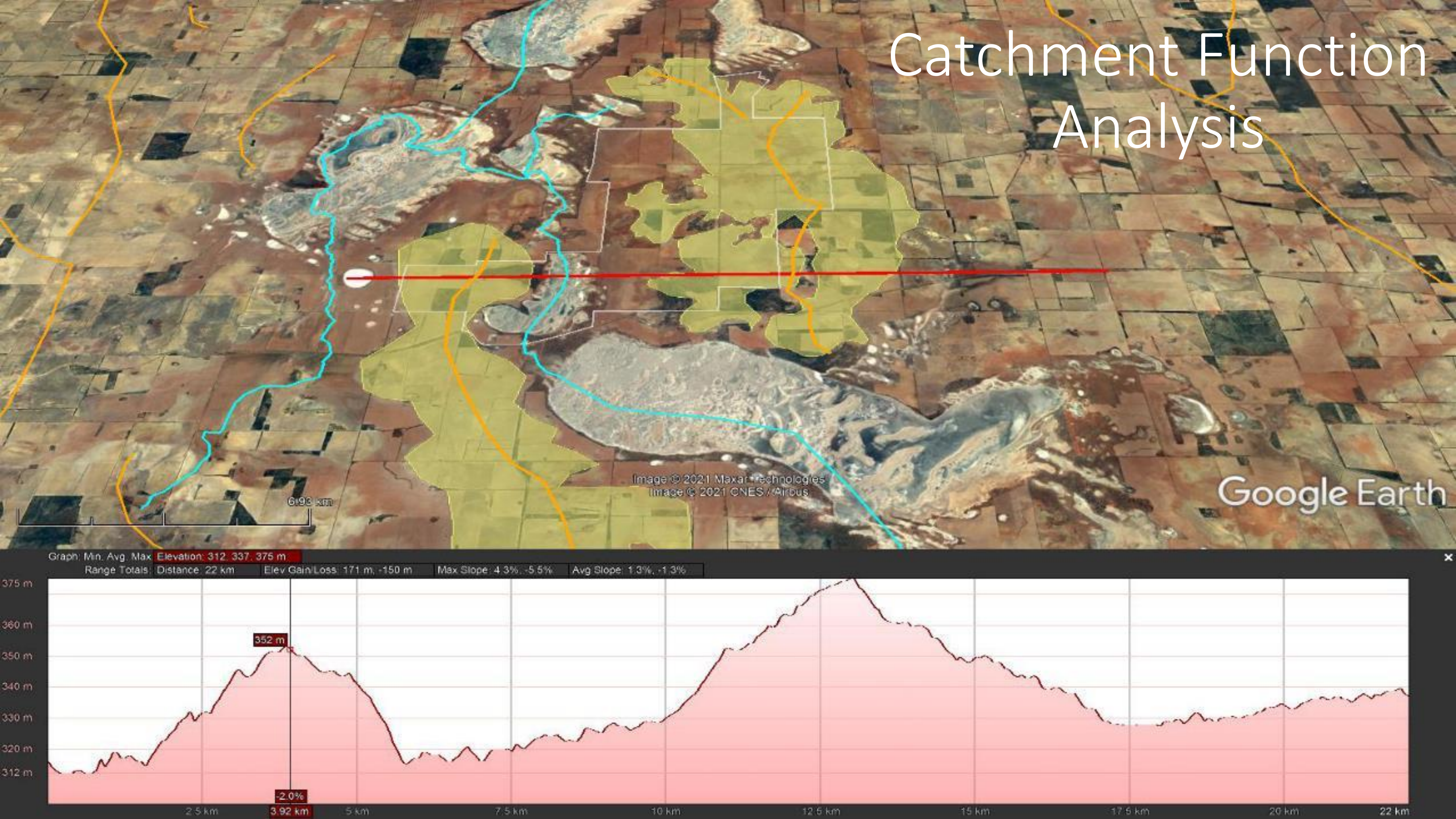


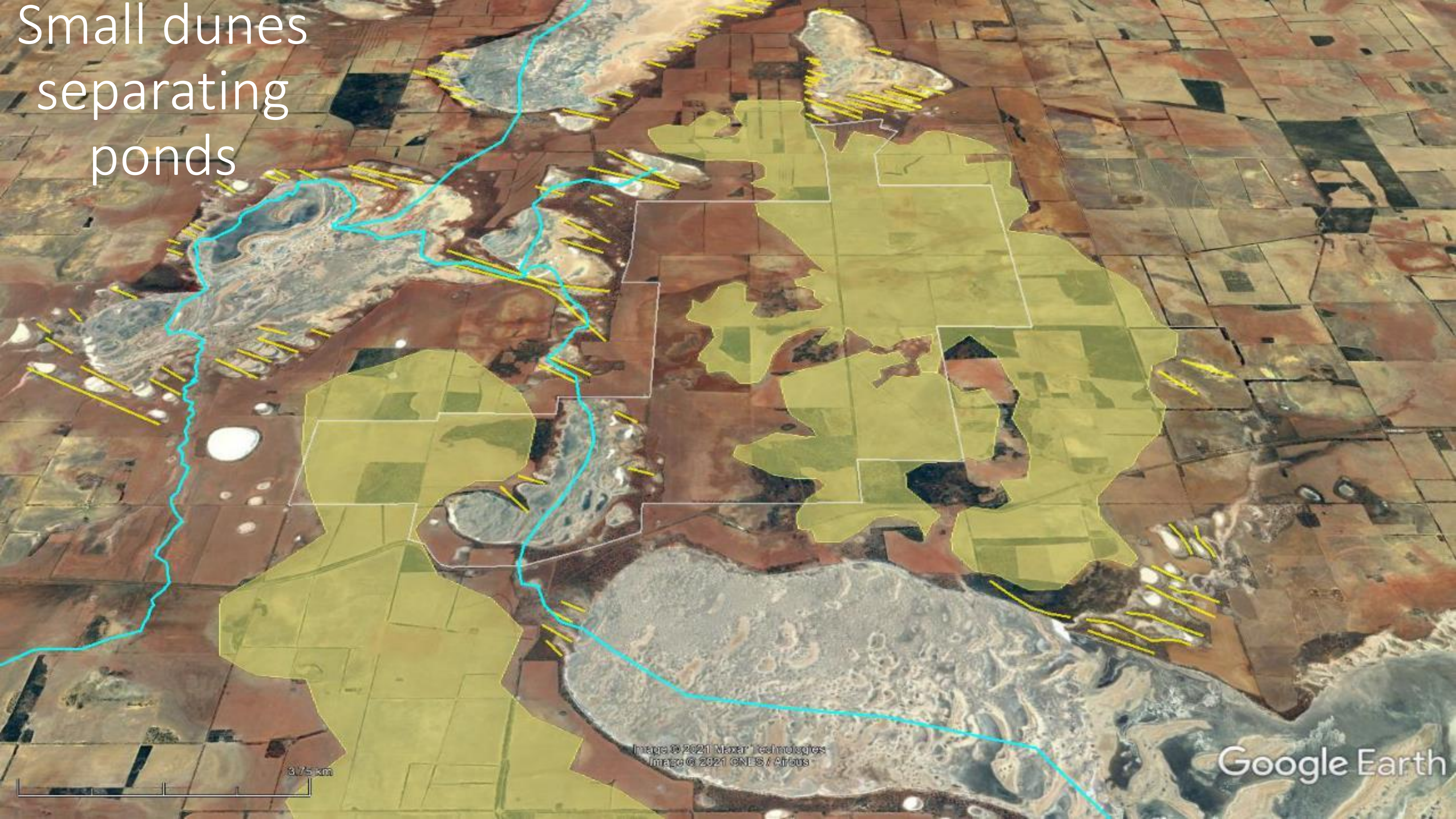

HEALTH WARNING
THIS WATER CONTAINS HARMFUL ALGAE.
DO NOT FISH. DO NOT COLLECT CRABS,
OR SHELLFISH FROM THESE WATERS.
FOR FURTHER INFORMATION:
http://ww2.health.wa.gov.au/News
Government of Western Australia
Department of Health

New model for financing landscape restoration

- **Ecosystems Services**
  - The services the environment delivers of **benefit to people**
  - E.g. food, clean water & air, flood control, CO_2e - climate, culture & recreation
- **Natural Capital**
  - The components, processes and functions that deliver those ecosystems services
- We can put a **$$ value** on Natural Capital
  - E.g. TEEB tool from the UN (The Economics of Ecosystems & Biodiversity)
- Natural Capital used as an **asset to back** a new class of financial instruments
  - E.g. Green Crypto coin
- Money raised to **fund** landscape restoration & **reward** land holders

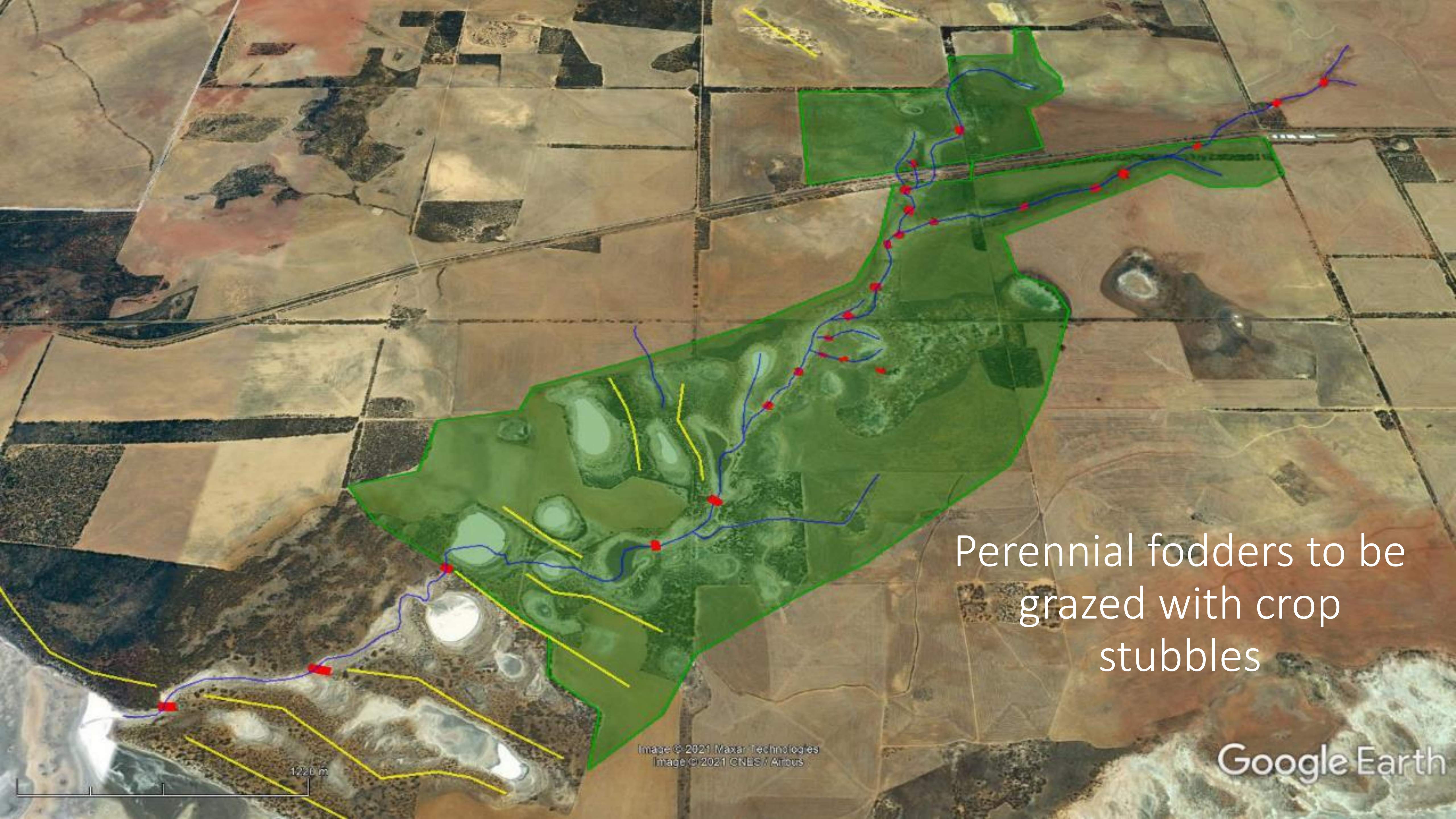
Catchment Function Analysis




Small dunes separating ponds
Image © 2021 Maxar Technologies
Image © 2021 CNES / Airbus
3.75 km
Google Earth


Creek draining slopes
Image © 2021 Maxar Technologies
Image © 2021 CNES / Airbus
3.75 km
Google Earth


Rehydrate creek system
Image © 2021 Maxar Technologies
Image © 2021 CNES / Airbus
Google Earth

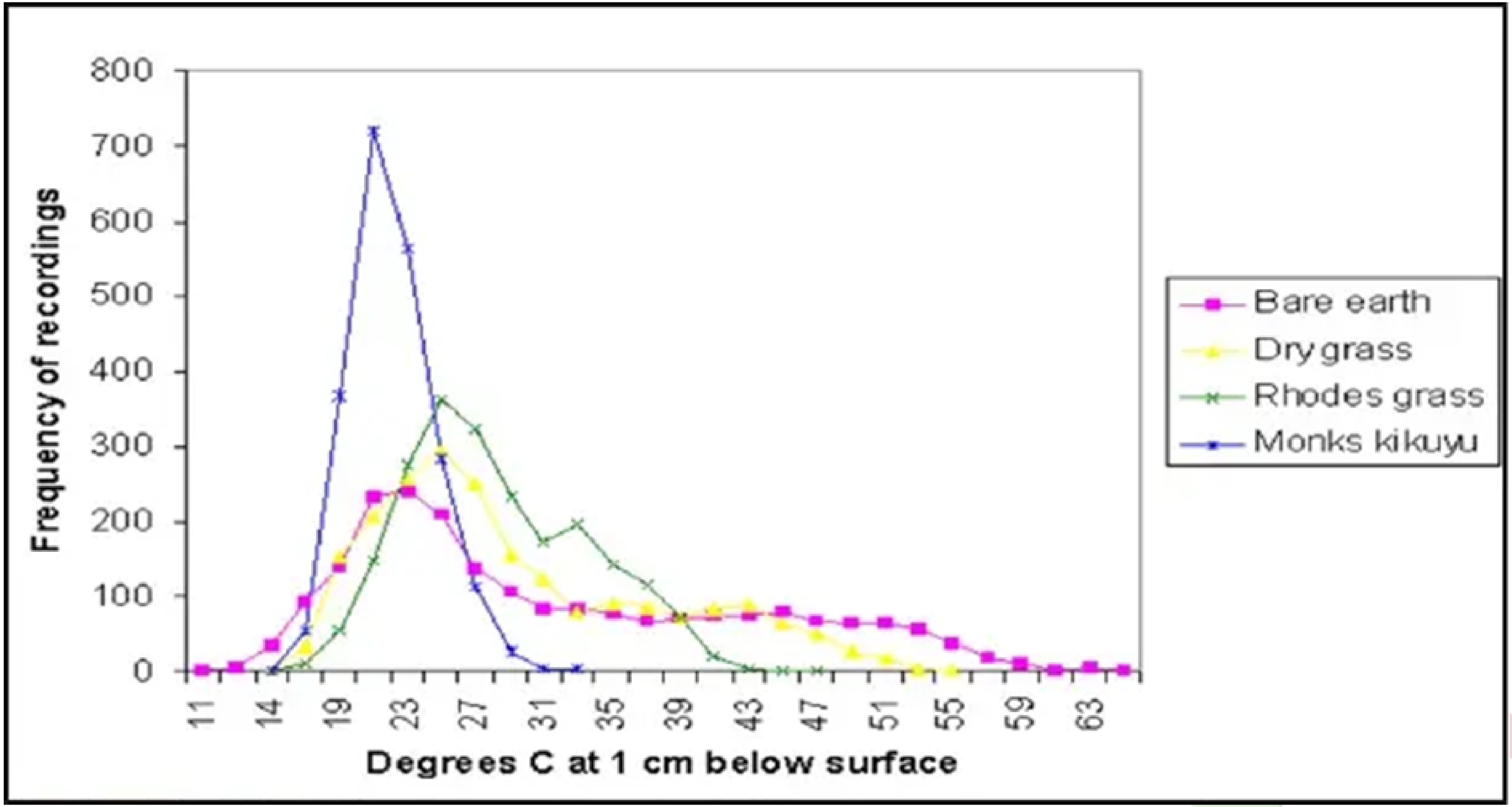

Perennial fodders to be grazed with crop stubbles
Image © 2021 Maxar Technologies
Image © 2021 CNES / Airbus
1220 m
Google Earth

Native perennial grass

Paspalidium

Haggerty’s

Soil Temperatures over summer at Bibby Springs
(hourly temperatures over 86 days)

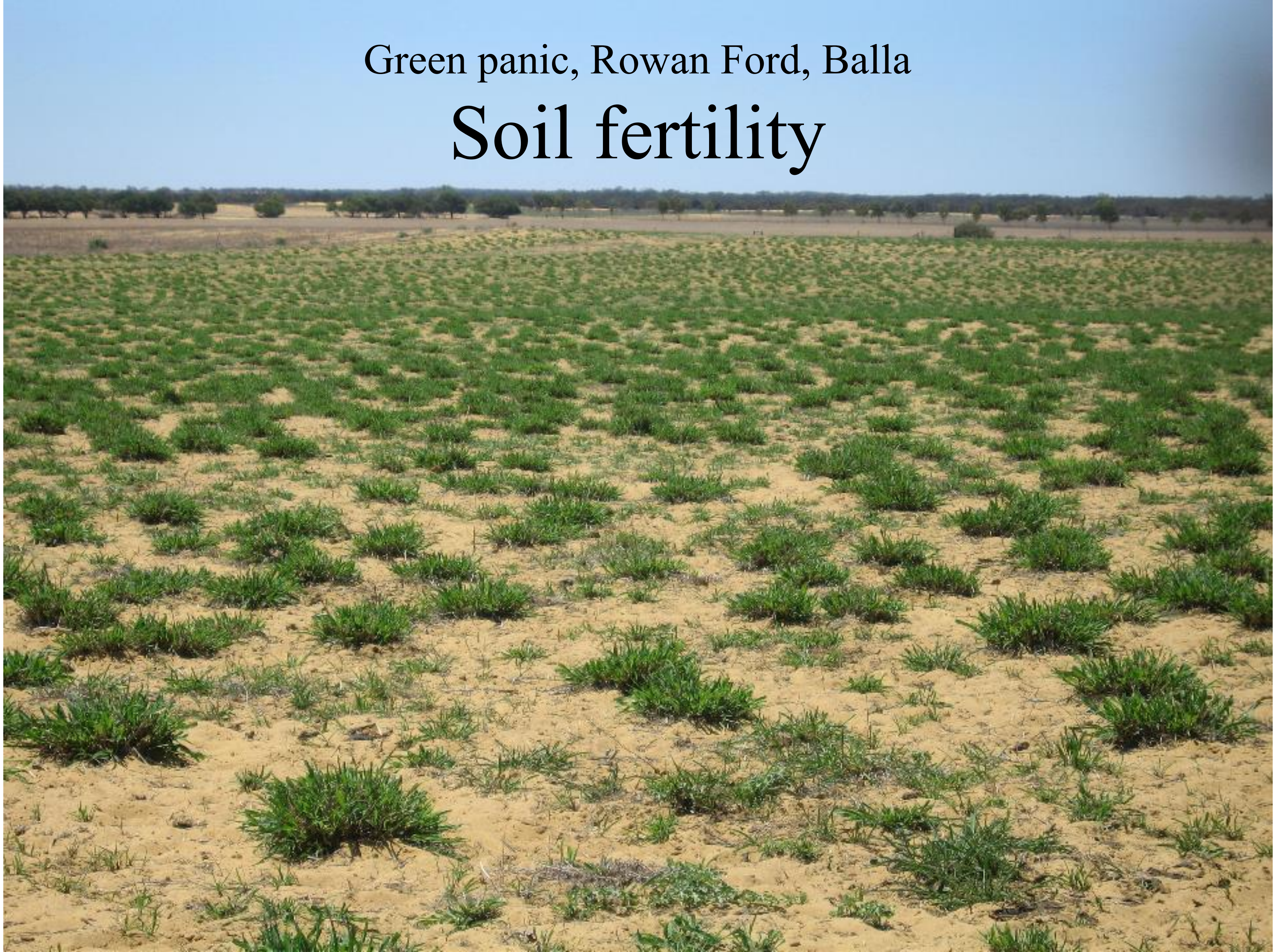


Maximum soil temperature

Ground cover	Maximum temperature ^{0}C
Bare soil	65
Thick dead grass	54
Rhodes grass – no extra soil moisture	48
Kikuyu – perched fresh water at 1m	34

Green panic, Rowan Ford, Balla

Soil fertility



Soil test results, Rohan Ford, Binnu

	Between panic crowns	**Within panic crowns**
Available P (Colwell P ppm)	**21**	**71**
Nitrate N (ppm)	**4**	**2**
Ammonium N (ppm)	**2**	**3**
Organic Carbon (Walkley Black %)	**0.24**	**1.04**
Potassium (Colwell K ppm)	**44**	**150**
Sulphur (ppm)	**2.7**	**7.9**
pH CaCl	**5.8**	**7.1**
pH water	**6.4**	**7.8**

Interventions to restore landscape functions

- Earth works & rehydration
- Increase ground cover
  - to reduce soil temperature
- Perennial plants
  - use extra water, grow feed, improve soil fertility, store Carbon
- Trees & shrubs
  - oil mallees, biodiversity plantings
- Mosaic of land uses
  - Integrating live stocking into cropping
    - in-crop weed control by sheep
    - Salt land pastures + crop stubbles in summer
    - Back grounding pastoral cattle

Thank You

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AUSTRALIA