



water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

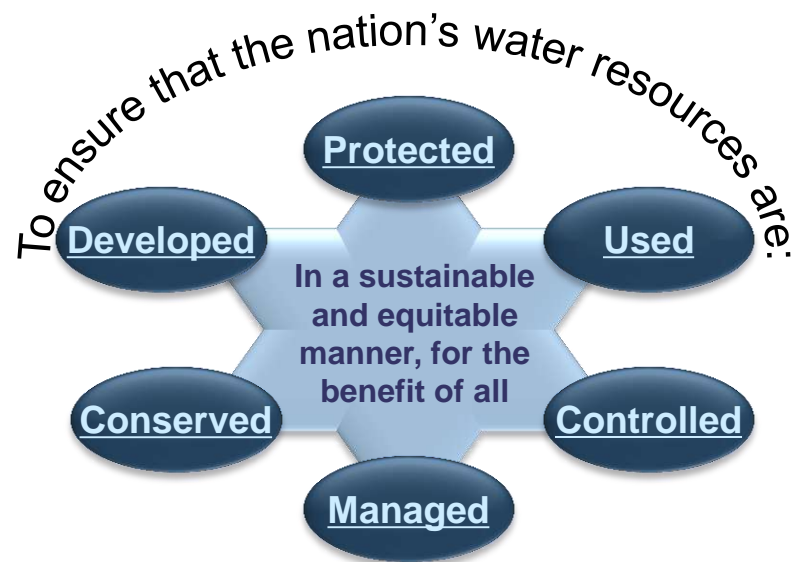
Hydrogeology in Water Use Authorisation

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Legal Framework

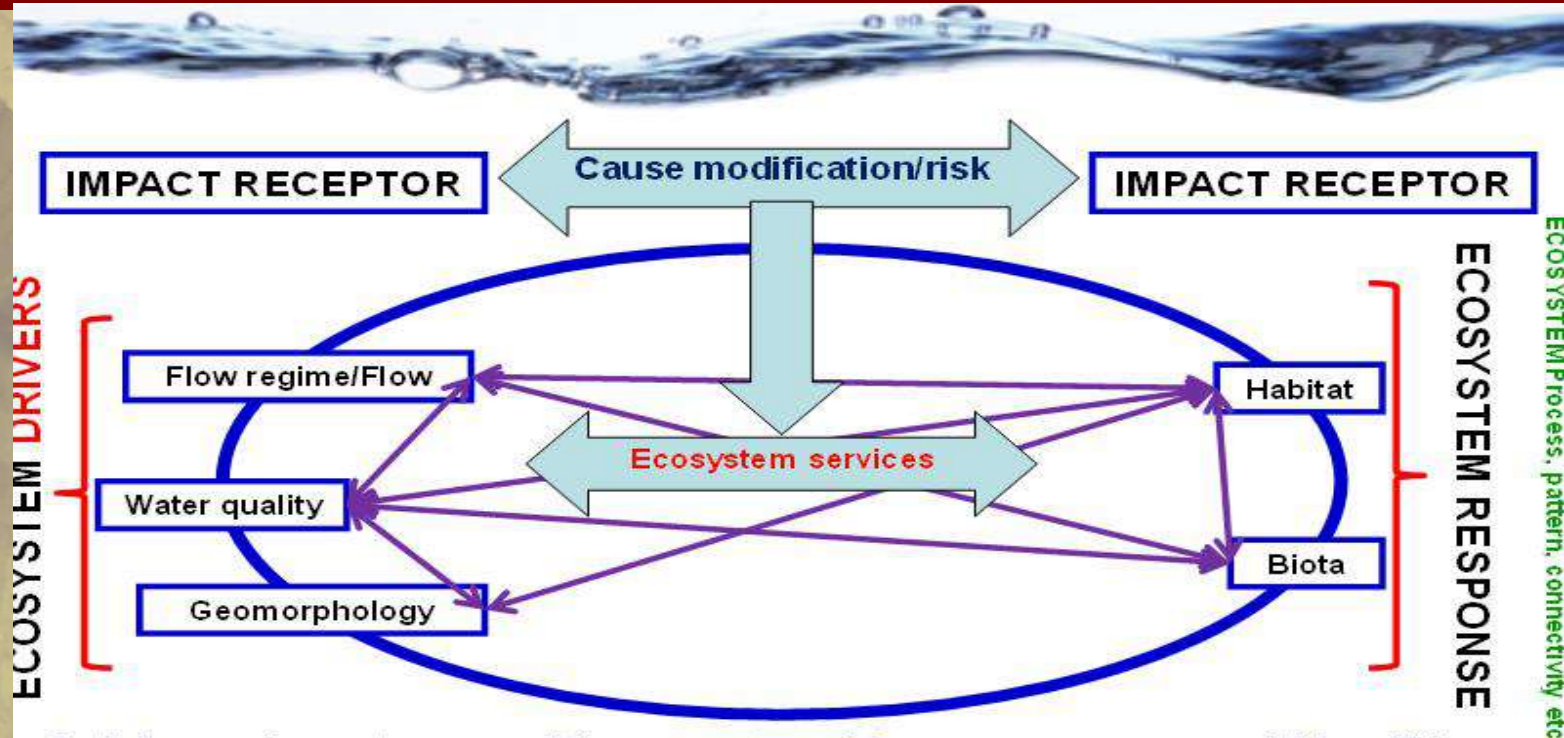
National Water Act, 1998 (Act 36 of 1998)



Resource Quality Characteristics

Resource Quality:

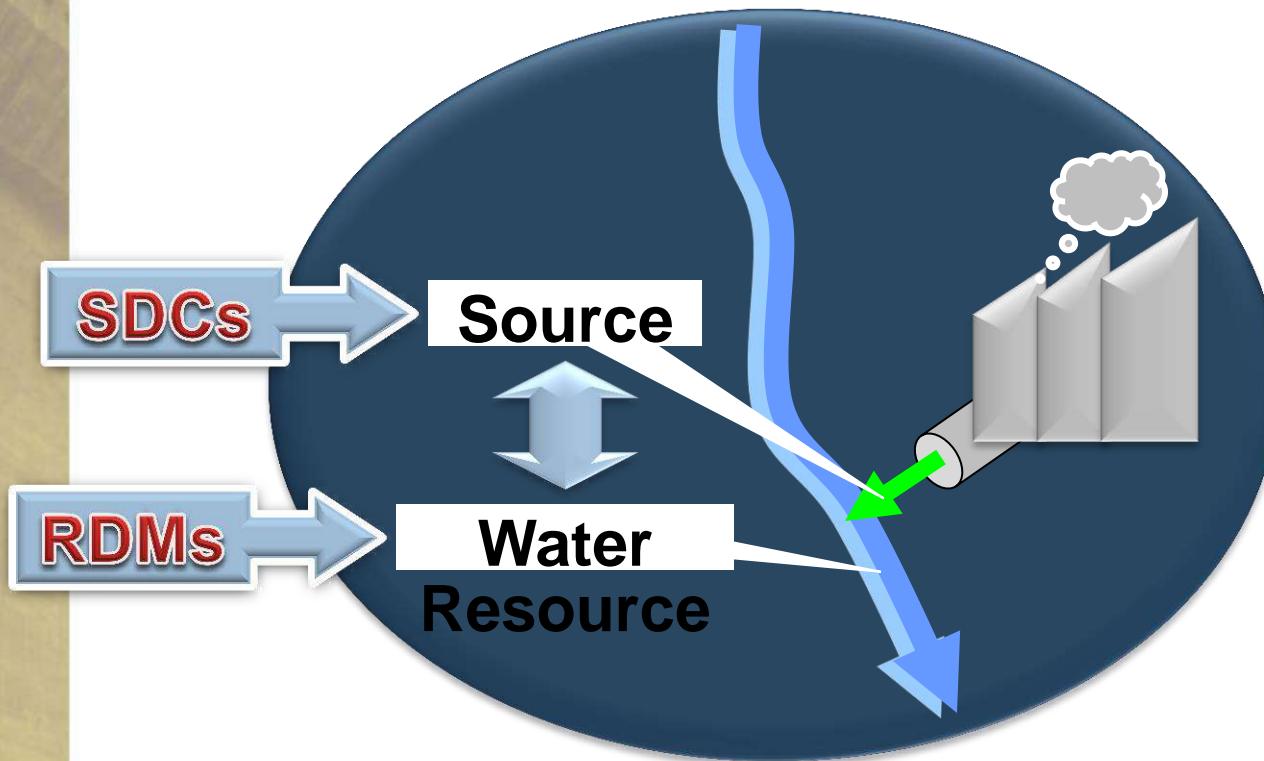
1. the quantity, pattern, timing, water level and assurance of instream flow;
2. the water quality, including the physical, chemical and biological characteristics of the water;
3. the character and condition of the instream and riparian habitat; and
4. the characteristics, condition and distribution of the aquatic biota.



Activity can impact on any of the ecosystem **drivers** or **responses** and this will have a knock-on effect on potentially all the other drivers and or responses
This will impact on ecosystem services provided

Resource Protection vs. Source Directed Controls

- NWA promotes two complimentary approaches to achieve IWRM



RDMs

1

Classification

- Classification system – guidelines and procedures to determine classes of water resources
- Management Class (minimally – heavily used) = desired characteristics of the resource
- Sets boundaries for volume, distribution and quality of Reserve and RQOs

2

Resource Quality Objectives

- Numeric / descriptive goals for resource quality within which the resource must be managed

3

Reserve

- Water quantity and quality required to:

Habitat

Biota

Quantity

Quality

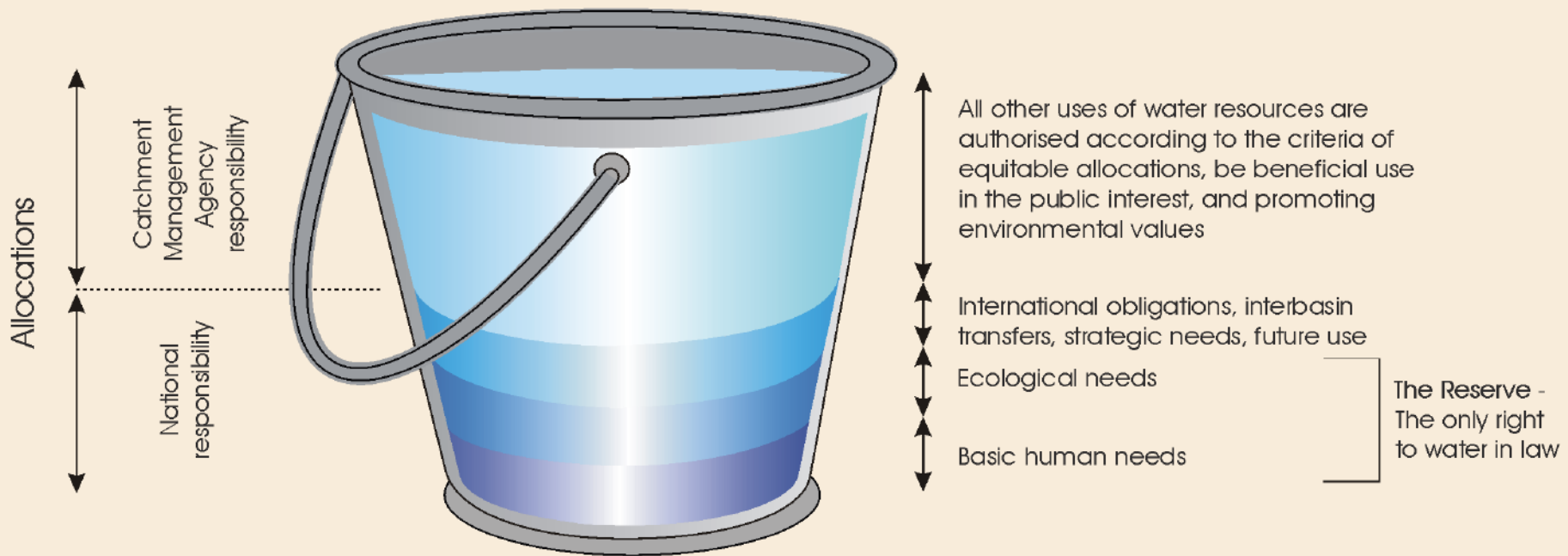
Supply BHN

Protect aquatic ecosystems



Balancing equity with sustainability-

THE RESERVE

If all the water in the country could be put into a bucket, the *Reserve* is the water that must always be left in the bucket for basic human and ecological needs.



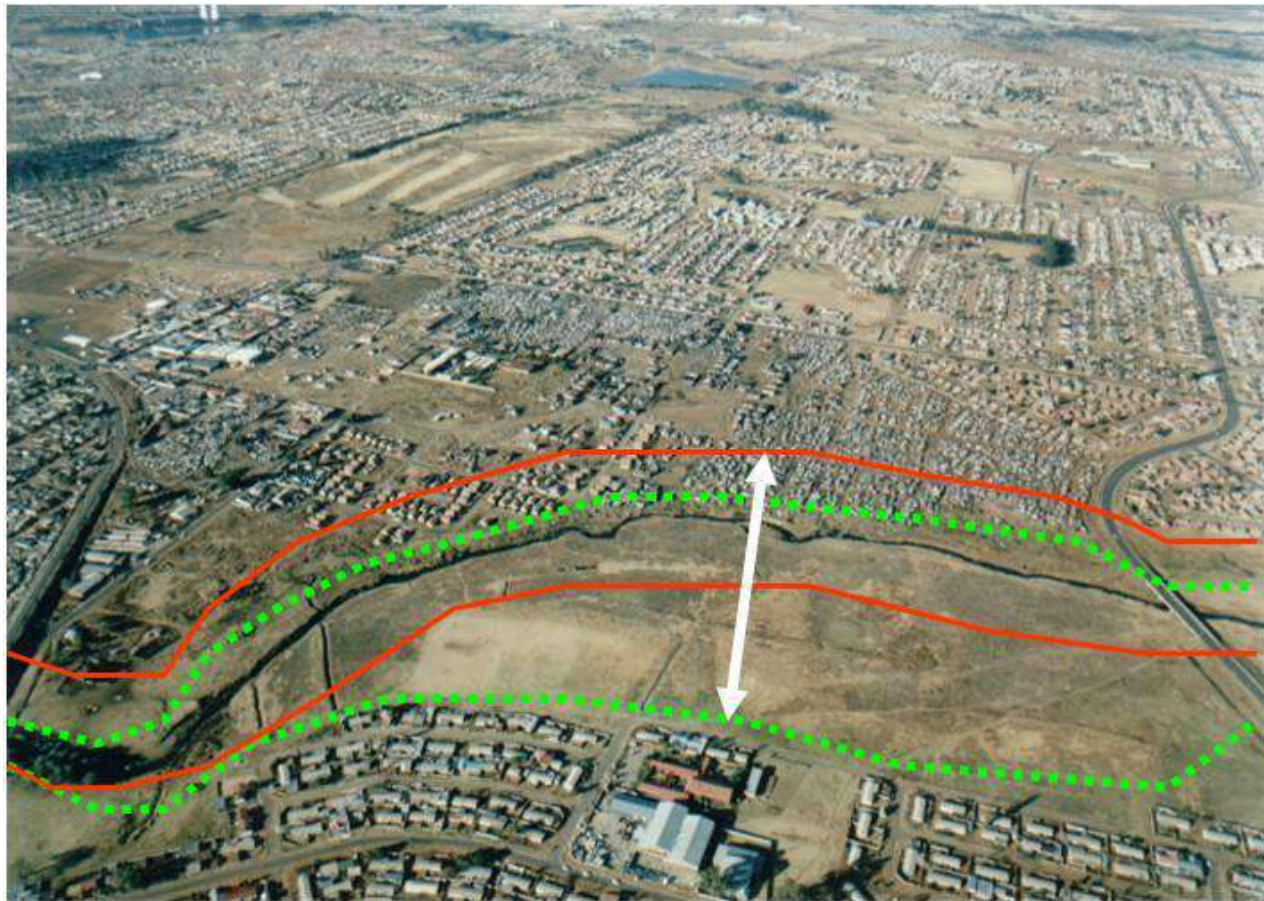
S21 Water Uses

S21(a)	Taking water from a water resource
S21(b)	Storing water
S21(c)	Impeding or diverting the flow of water in a watercourse 
S21(d)	Engaging in a stream flow reduction activity
S21(e)	Engaging in a controlled activity
S21(f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit
S21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource
S21(h)	Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process
S21(i)	Altering the bed, banks, course or characteristics of a watercourse 
S21(j)	Removing, discharging or disposing of water found underground for the continuation of an activity or for the safety of persons
S21(k)	Using water for recreational purposes

Water Resource vs. Watercourse



- A river;
- A spring;
- A natural channel in which water flows regularly or intermittently;
- **A wetland**; lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse include, where relevant, its bed and banks.



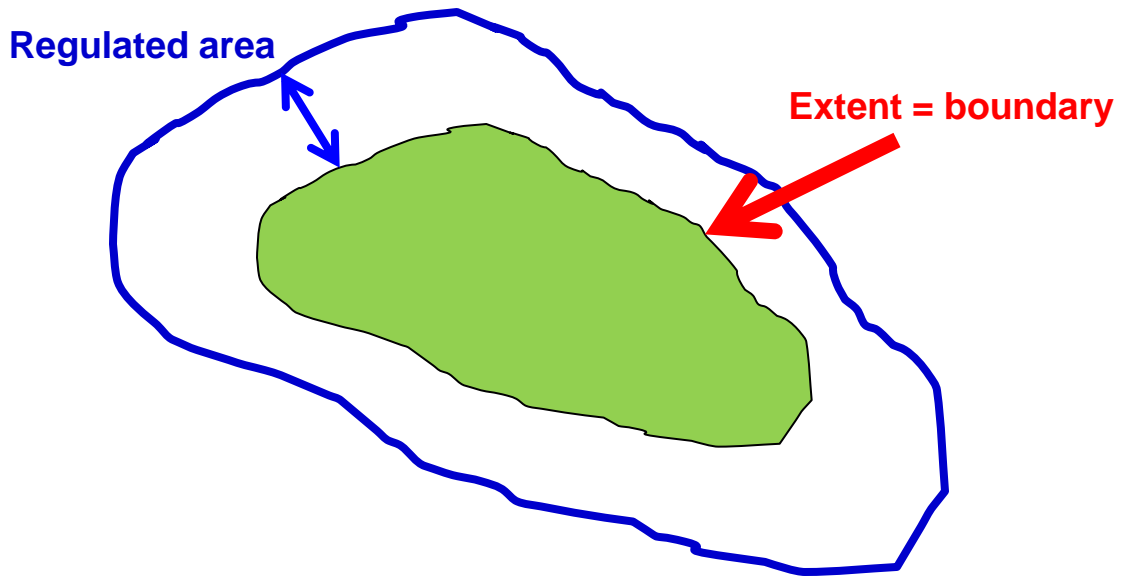
..... 1:100 floodline

— Riparian zone

Extent of watercourse

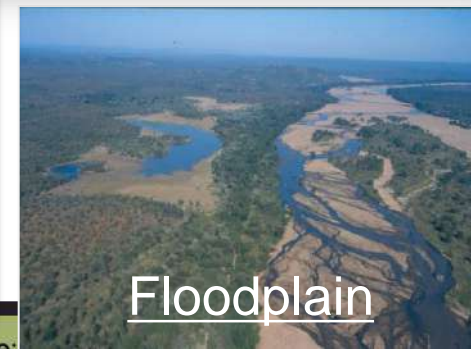
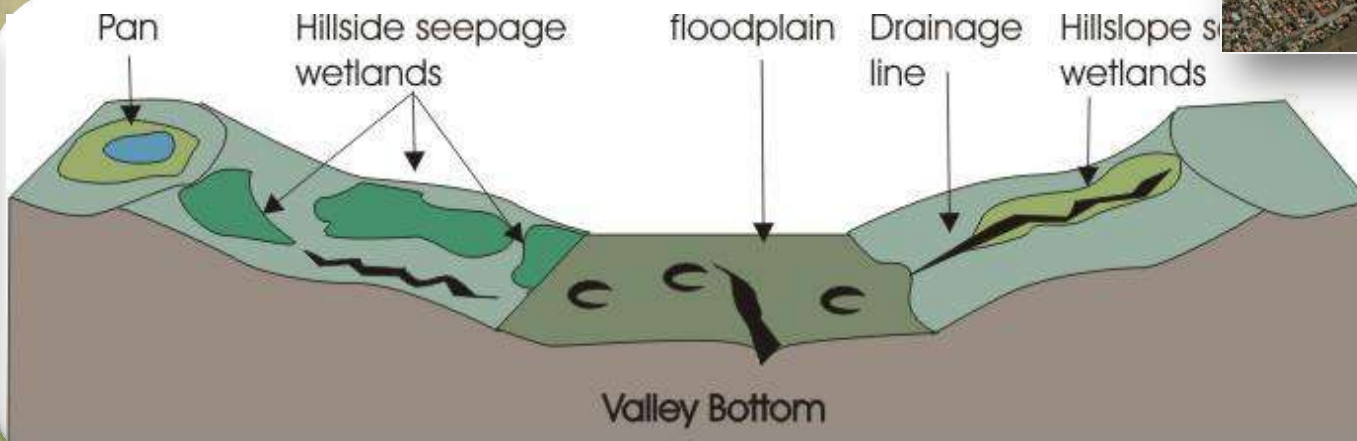
WETLANDS - Definition

- 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
- Supports vegetation typically adapted to life in saturated soil



WETLANDS - Types

- Hydro geomorphic (HGM) classification system classifies wetlands according
 - Form (geomorph-characteristics)
 - The way in which water moves in, through and out of the wetland system (hydro-characteristics)
- HGM classification system recognises 5 generic palustrine wetland types, namely:
 - Pans and depressions including lakes;
 - Seepage wetlands;
 - Unchannelled valley bottoms;
 - Channeled valley bottoms; and
 - Floodplains.



Hydrological function likely to be performed by a wetland according to hydro-geomorphic type

Wetland hydro-geomorphic type	Source of water maintaining the wetland		Hydrological functions potentially performed by the wetland								
	Surface	Sub-surface	Flood attenuation		Stream flow augmentation		Erosion control	Potential for water quality enhancement			
			Early wet season	Late wet season	Early wet season	Late wet season		Sediment trapping	Phosphate removal	Nitrates	Toxicants
Floodplain	*	0	++	+	0	0	++	++	++	+	+
Valley bottom-channelled	*	*	+	0	0	0	++	+	+	+	+
Valley bottom – unchannelled	*	*	+	+	+?	+?	++	+	+	+	++
Hillslope seepage with a stream channel	0	*	+	0	+	+	++	0	0	++	++
Hillslope seepage without a stream channel	0	*	+	0	+	+	++	0	0	++	++
Pan / Depression	*	*	+	+	0	0	0	0	0	+	+

Key: Water source 0 Contribution usually small
 * Important contribution

Rating:

0 Function unlikely to be performed to any significant extent
 + Function likely to be present at least to some degree
 ++ Function very likely to be present (and often performed to a high level)



Understanding the Science behind S21(c) and (i) Water Use information requirements

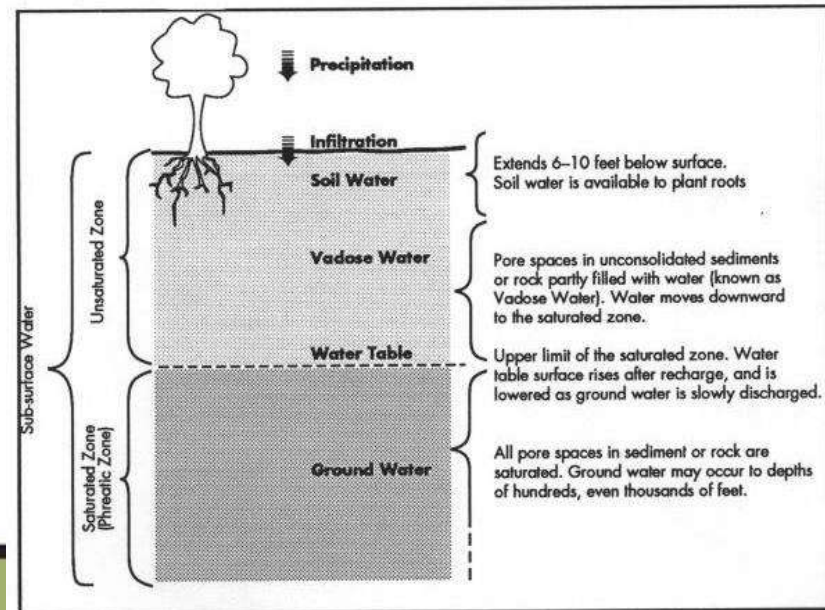
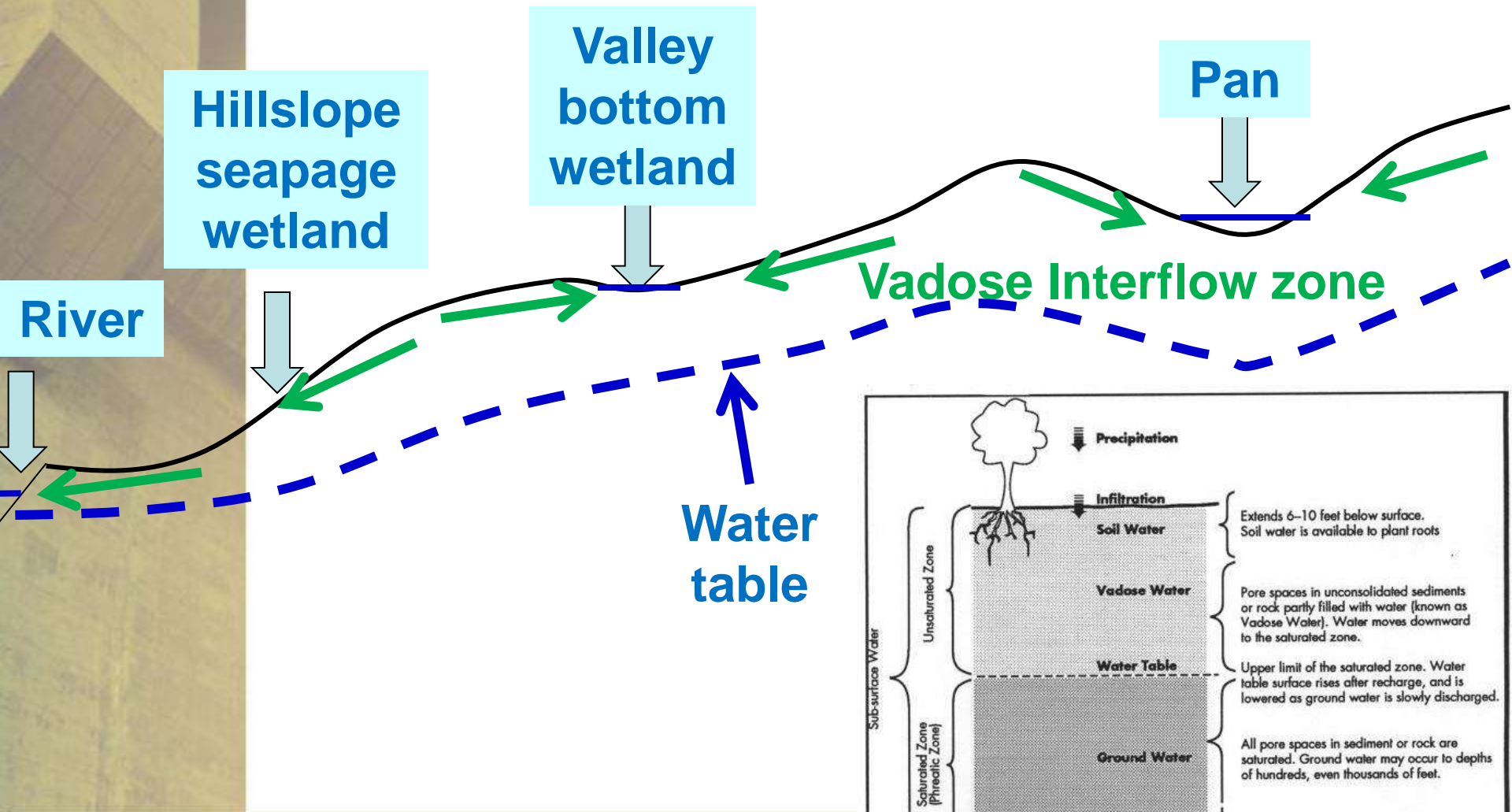




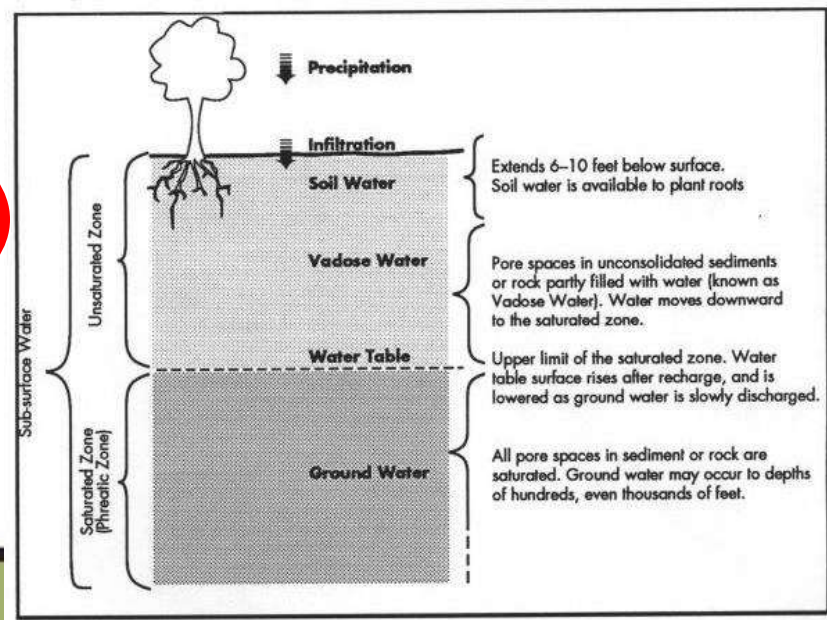
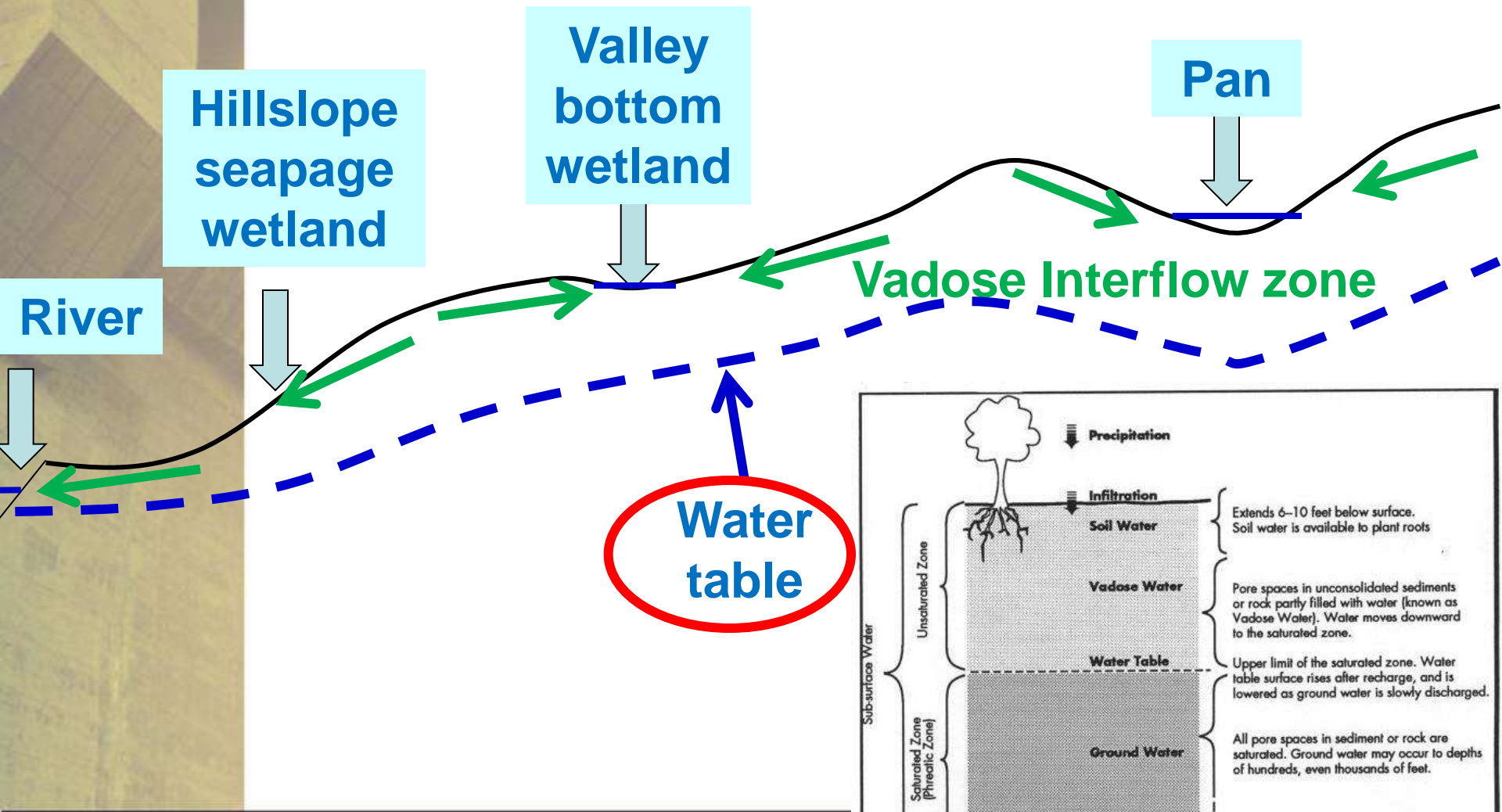
Water in the landscape

TWO IMPORTANT Continuums of water flow in the landscape

Water in the landscape: Invisible resource



Water in the landscape: Invisible resource



Groundwater surface water interface

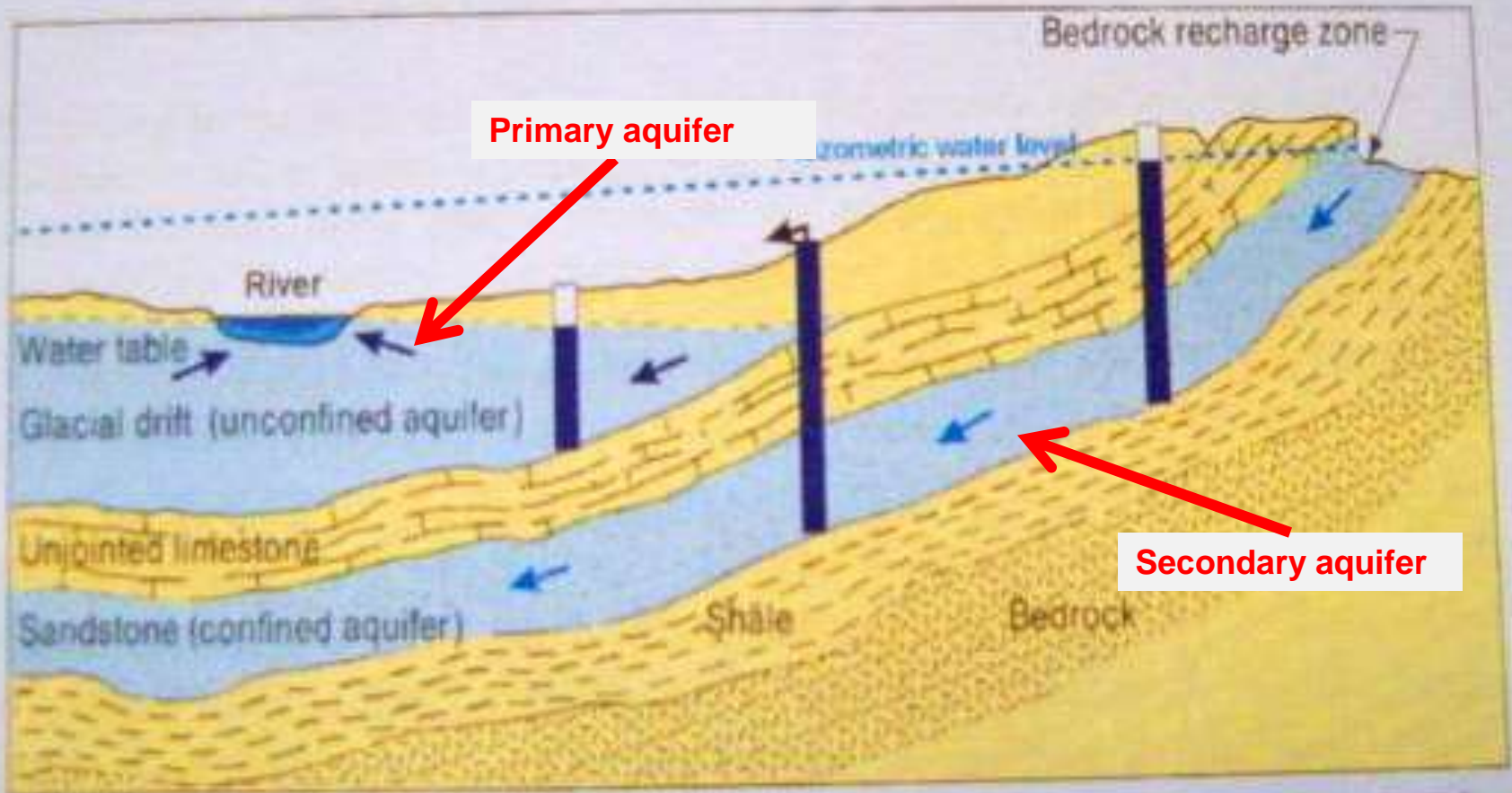
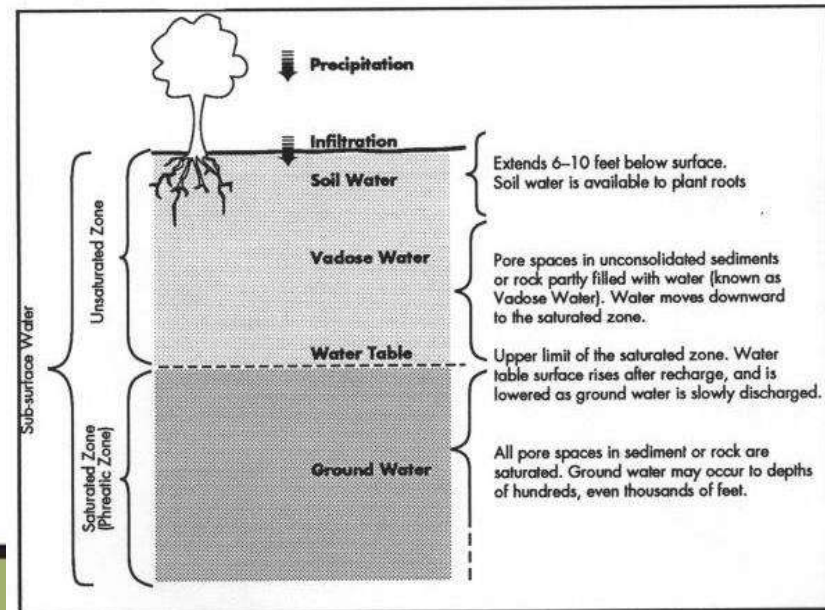
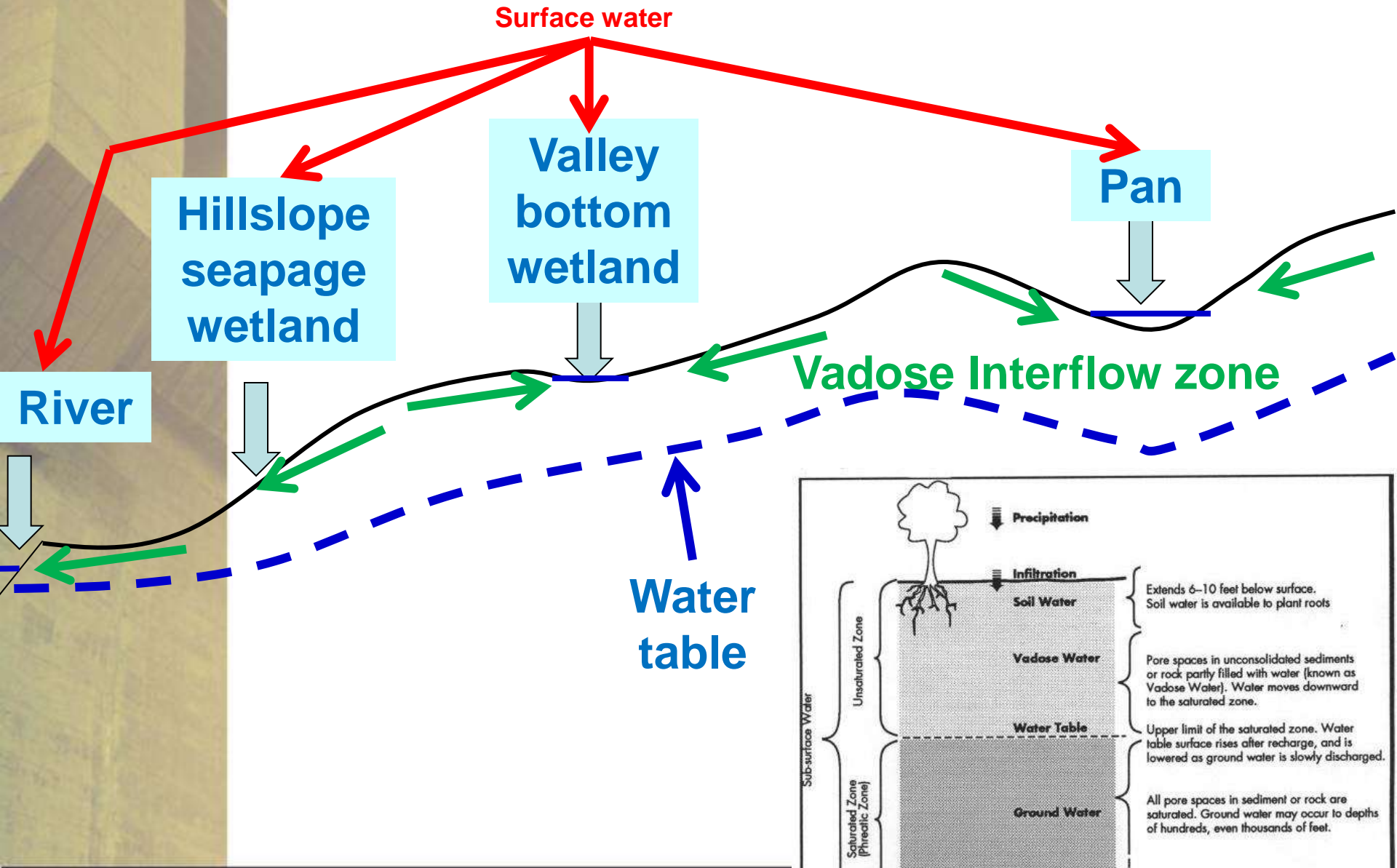
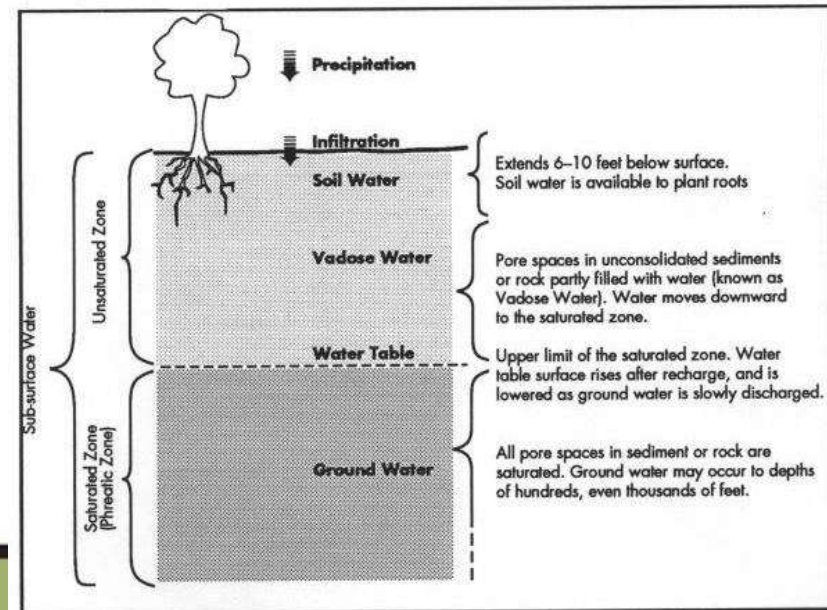
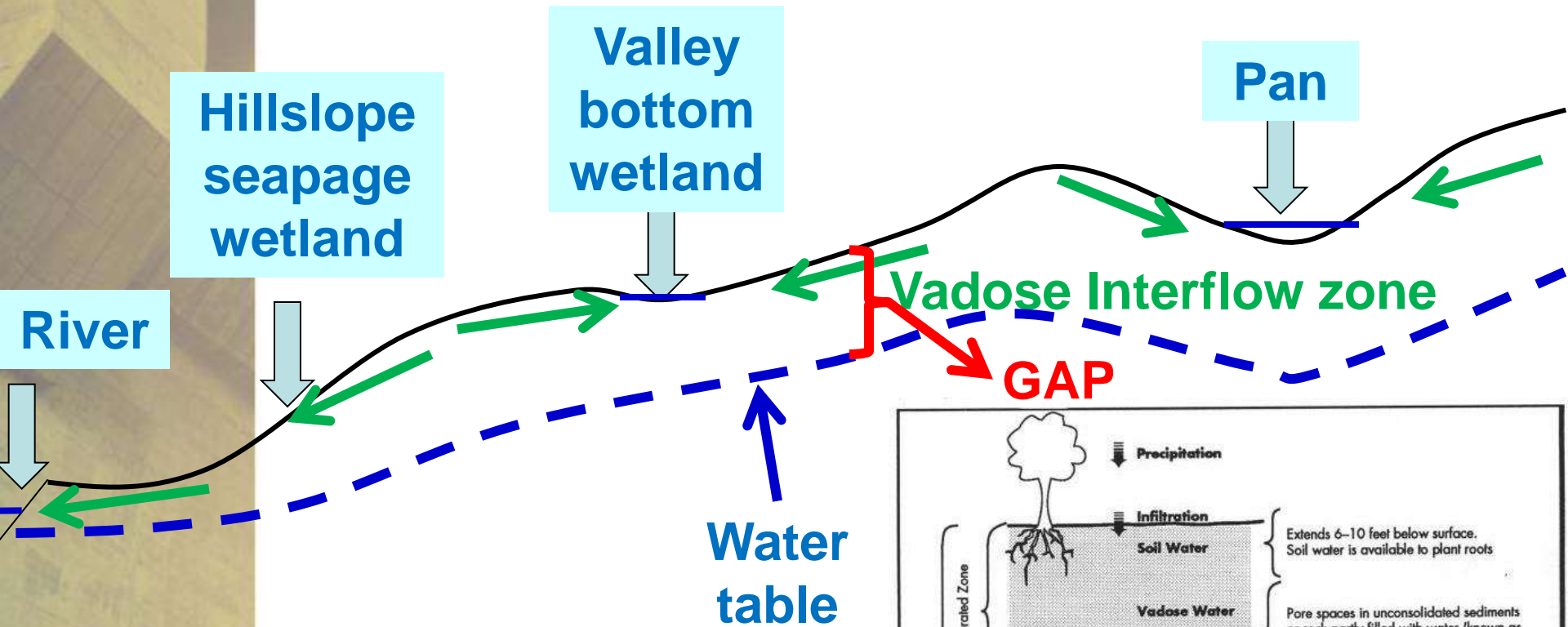


Figure 2.5 Groundwater flow in unconfined and confined aquifers (after Driscoll, 1986)

Water in the landscape: Invisible resource



Water in the landscape: Invisible resource



WHY IS THIS IMPORTANT?

Large part of the hydrological cycle happens here

Wetlands are the Apex of Hillslope Hydrology - Interflow

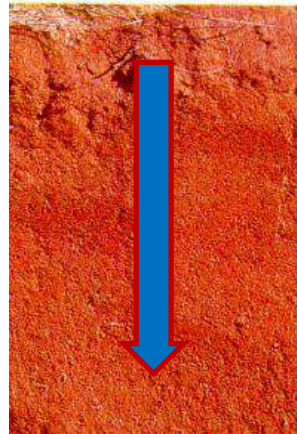


Hydropedology - interflow

Different soil types have specific hydrological properties

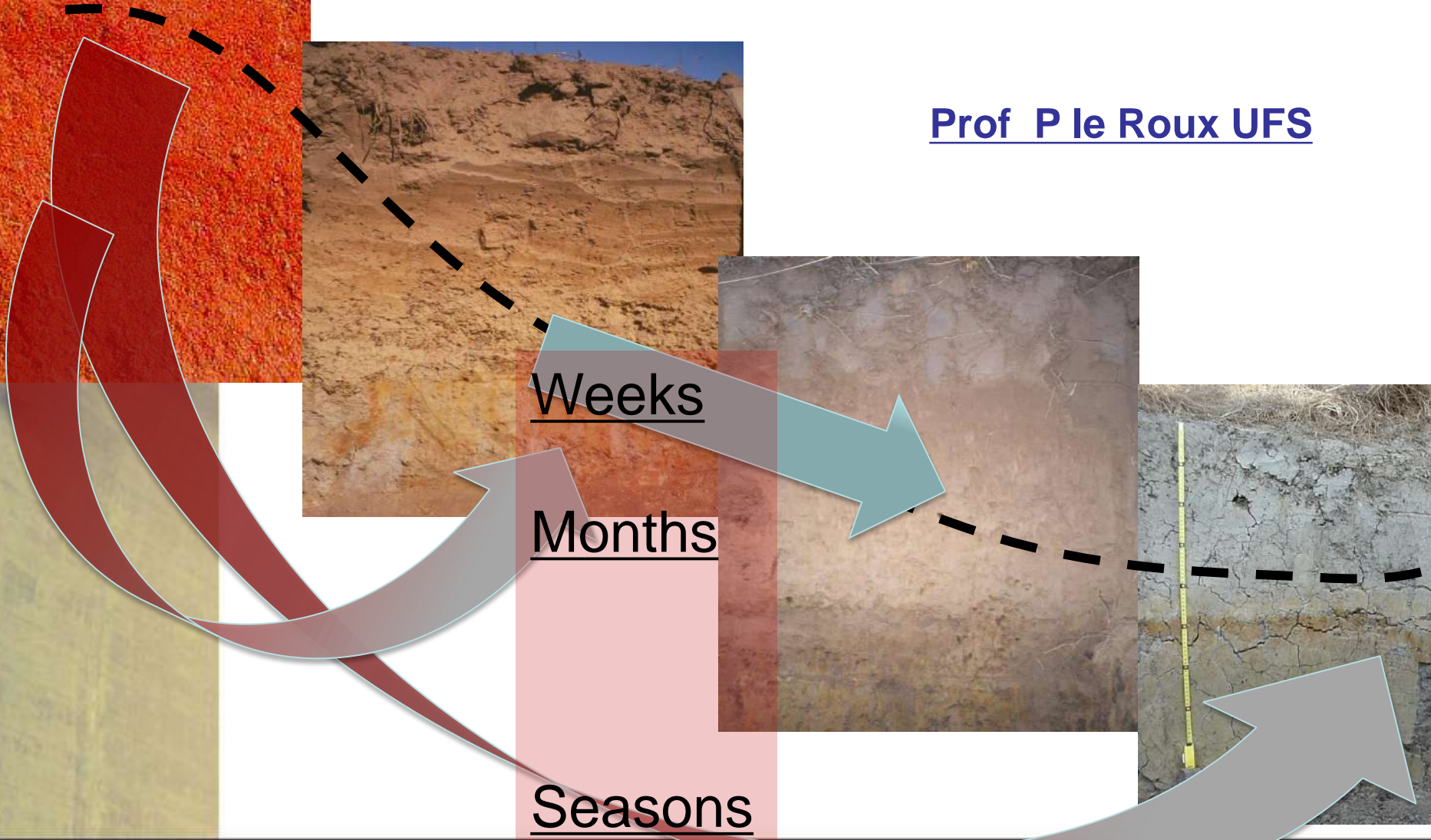
HILLSLOPE HYDROLOGY

- Recharge soils
- Interflow soils
 - Deep
 - Shallow
- Responsive soils
 - Wetland soils
 - Shallow soils on impermeable material (hard rock, hardpan carbonate, prismatic B)



Interflow flow paths and time frames

Prof P le Roux UFS





Relict wetland system – heavily cultivated
– no clearly defined signs of wetness on
the aerial imagery



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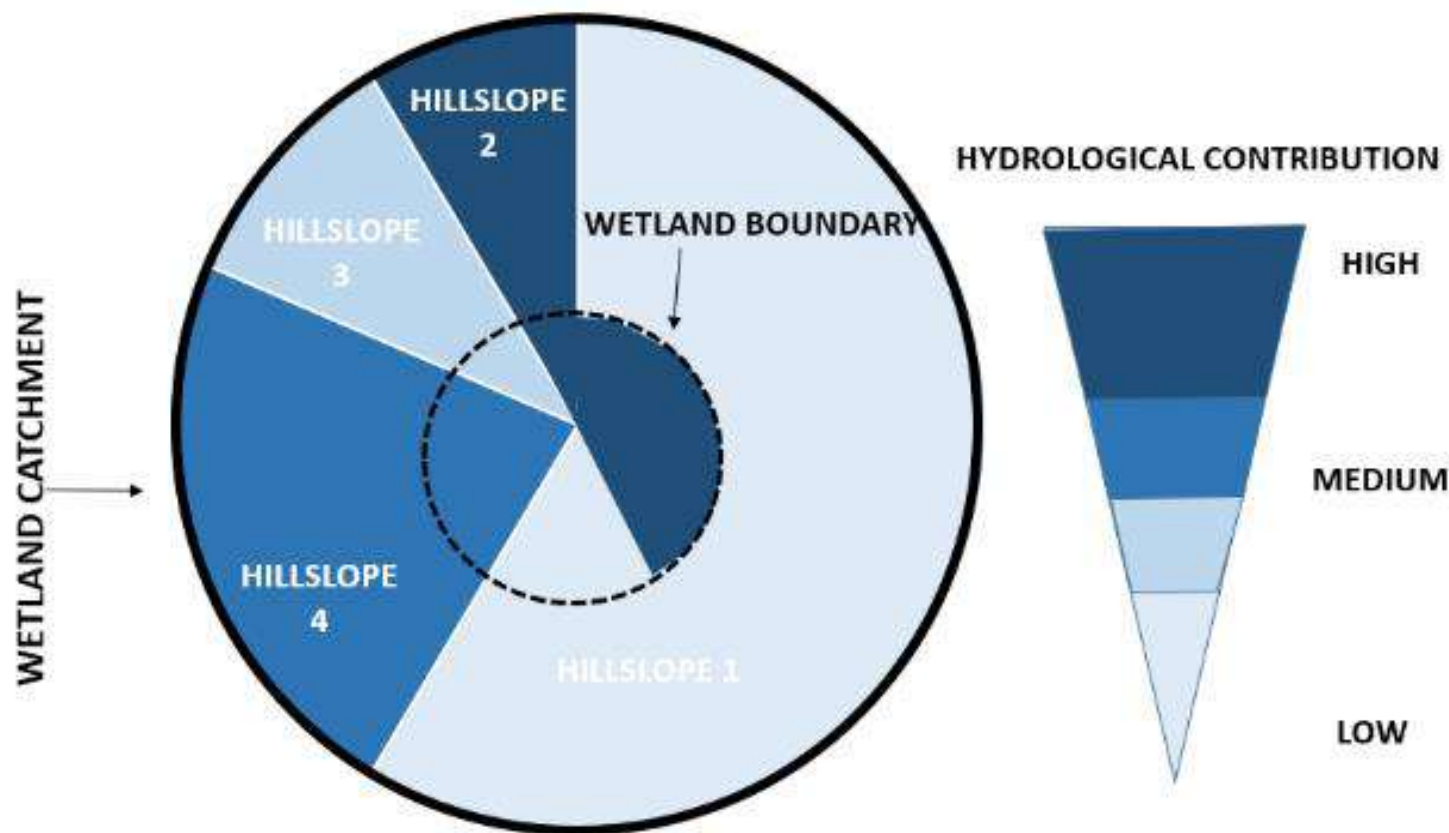
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WATER IS LIFE - SANITATION IS DIGNITY

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Job and Le Roux in prep (WRC report)



All ecological infrastructure is an expression of water flowing in and through the landscape

Also in relation to:

- Slope
- Aspect
- Climate
- Spatial location (biome)
- Spatial extent
- Geology and
- Soils

Flow of water is the primary drive of all ecosystems
WUA – need to understand level of modification flow
etc.

How to unpack the flow driver

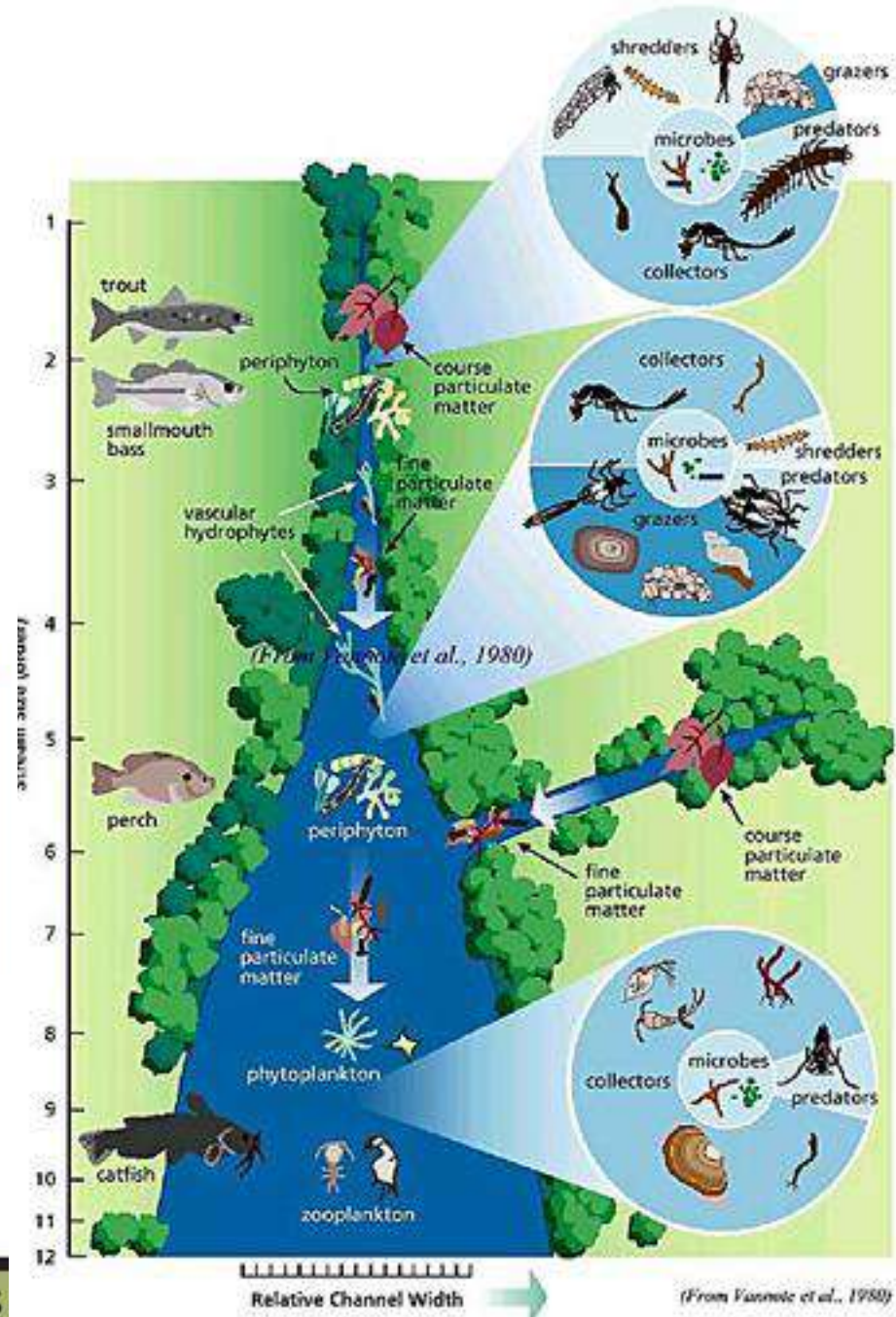
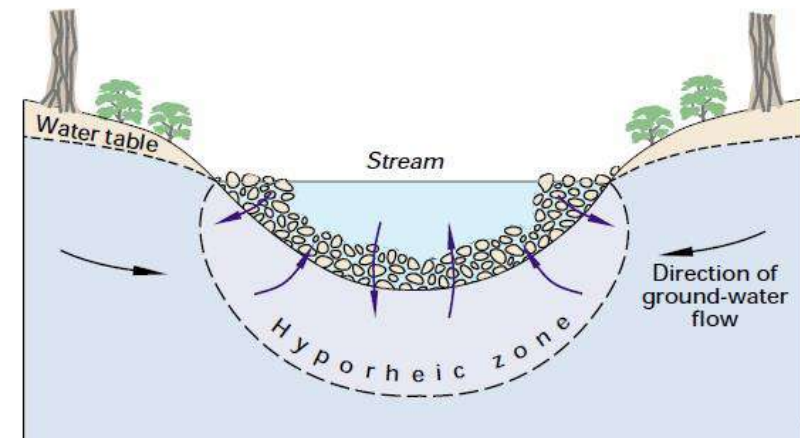
- Where if water coming from
- How much
- Spatial extent
- Temporal component
- Not all hillslopes are equal

Ultimately what will be the level of modification and how will response side be modified

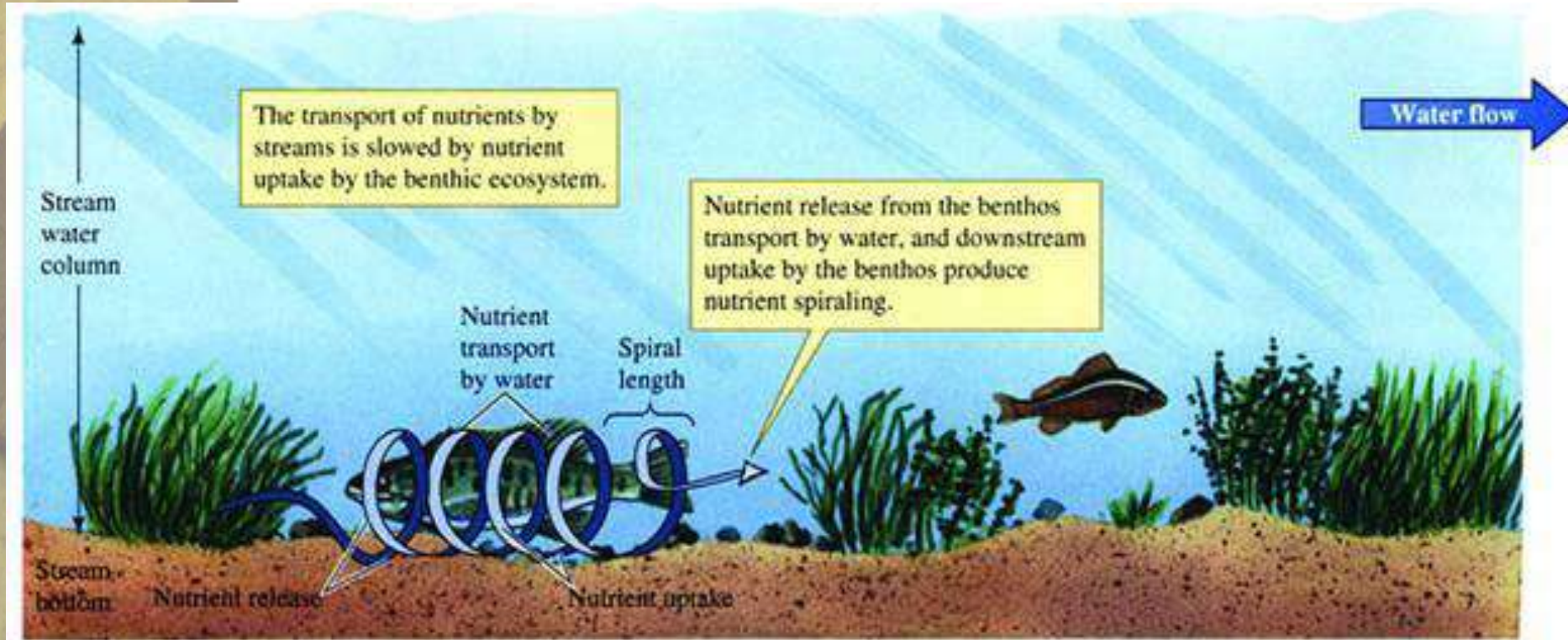
Basic components of river systems

- **River continuum**
 - All rivers form a continuous longitudinal ecosystem being progressively and continuously modified downstream from their headwaters to the sea
- **River reaches**
 - Characteristics of diff river reaches (physical, chemical, biological)
 - Mountain streams - Heterotrophic (detritus base)(allochthonous input)
 - Down stream – autotrophic (production)(autochthonous organic material)

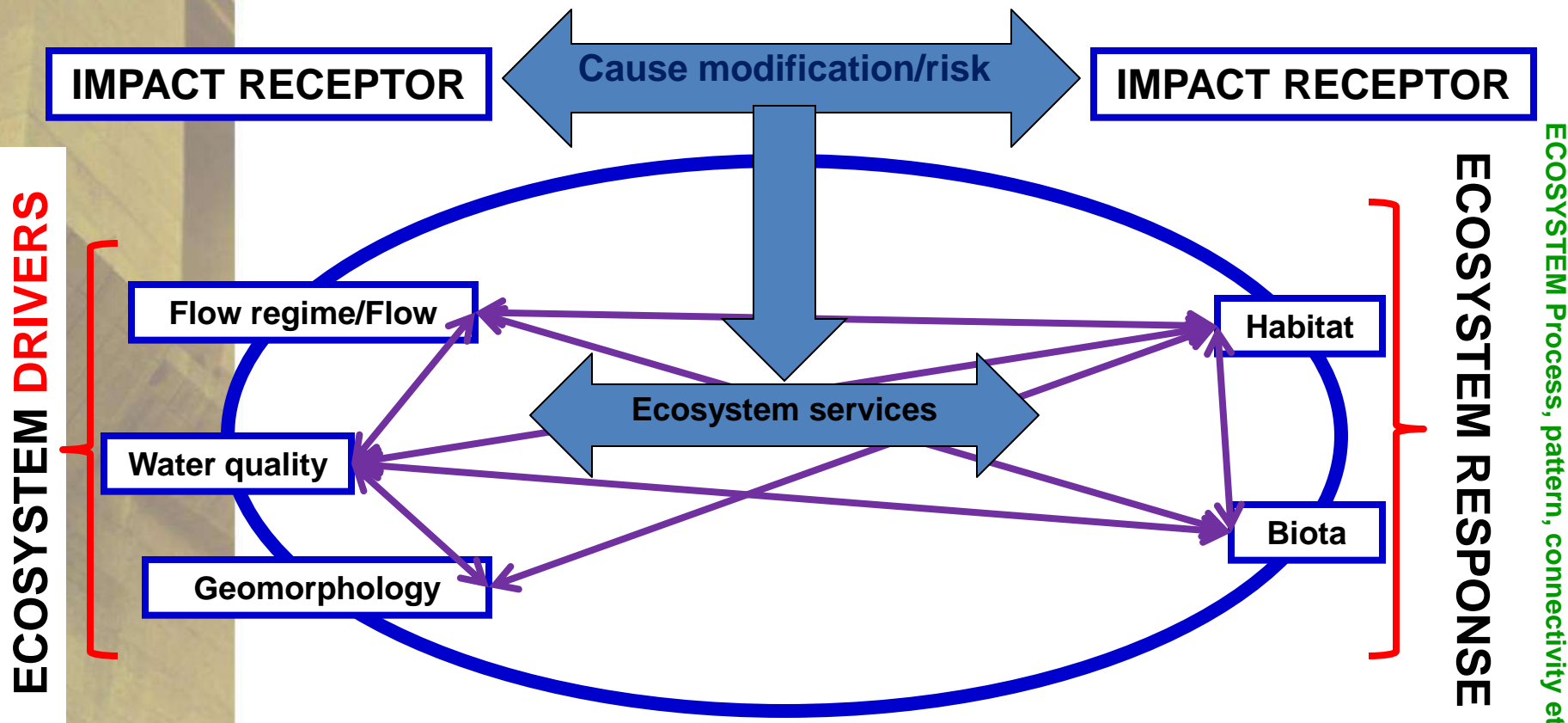
Basic components of river systems



Basic components of river systems



Nutrient spiraling hypothesis



Activity can impact on any of the ecosystem **drivers** or **responses** and this will have a knock-on effect on potentially all the other drivers and or responses

This will impact on ecosystem services provided

WULA and EIA must provide mitigation for these impacts

Water Use Authorisation

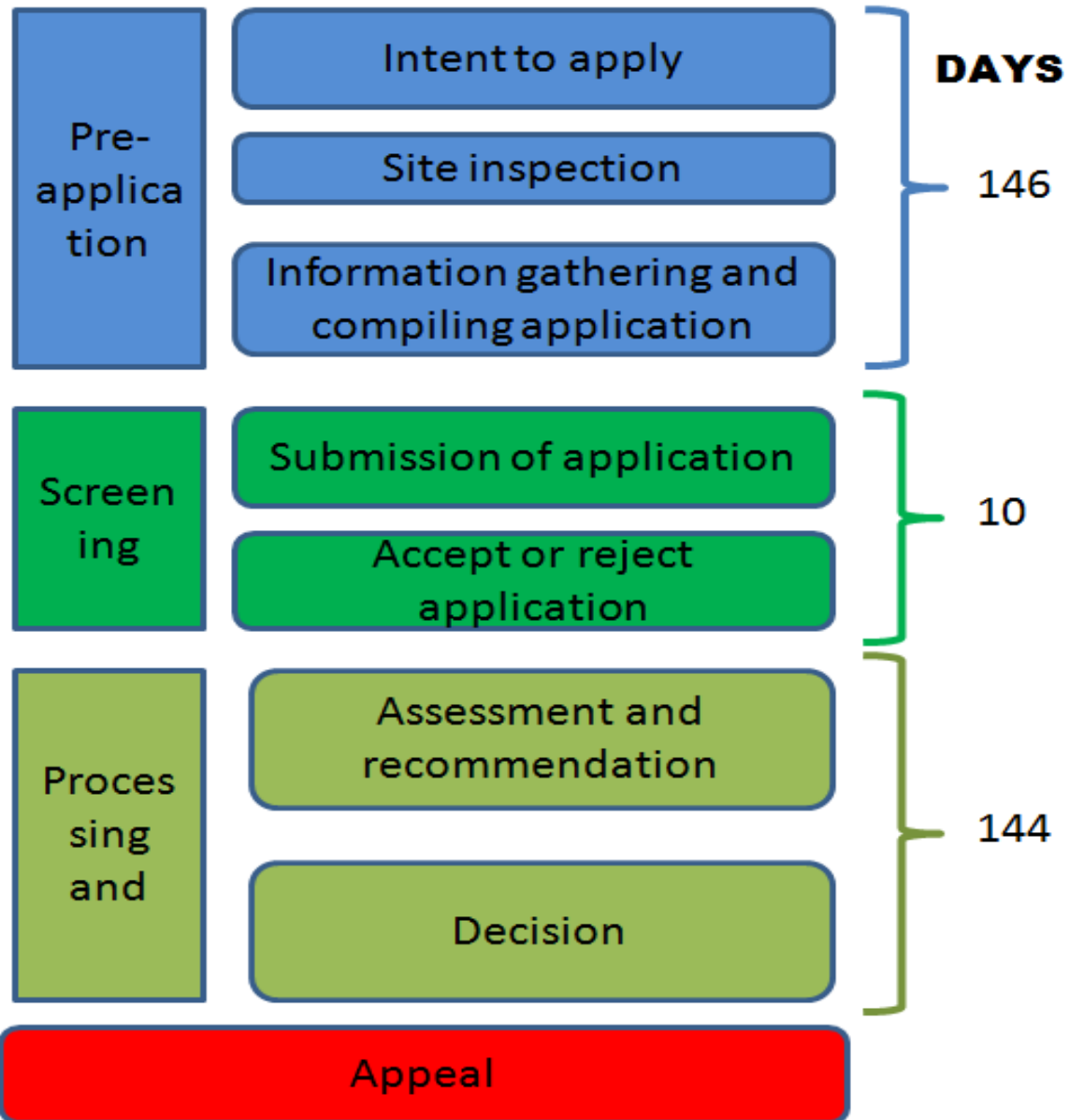
Administrative Process



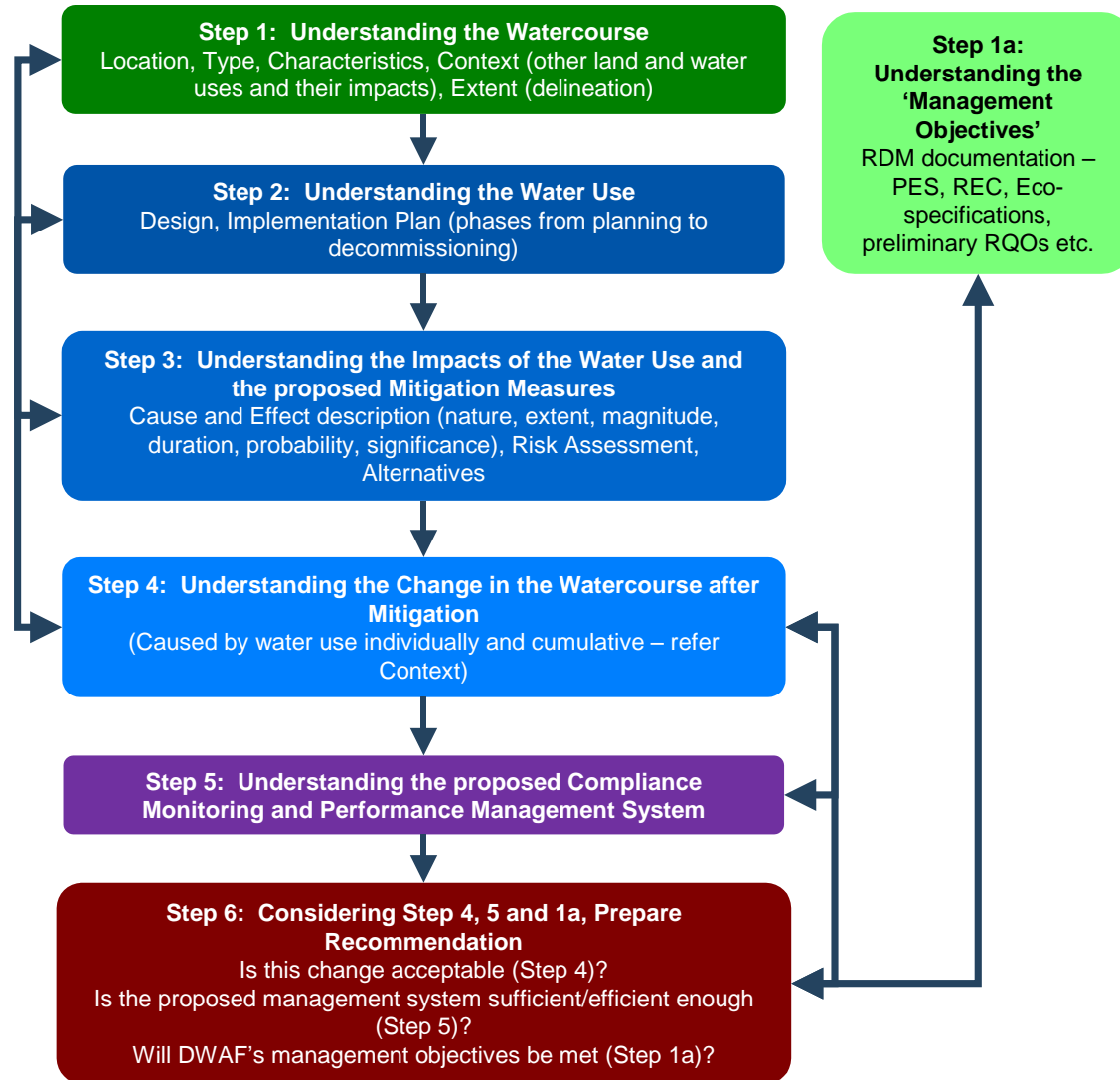
Technical Process



Water Use Licence Application Process



Technical Process



Guidelines available on website

- **Guideline “Development and Activities Affecting Wetlands**
- **Risk Assessment and Management Guidelines – Risk Matrix**
- **Wetland Offset Guideline**
- **Wetland Buffer Guideline**
- **Various WRC reports – High Risk Wetland Atlas**
- **Wetland Rehabilitation in mining landscapes**

Soon to be available

- **Updating Wetland Delineation Guideline**
- **Water Use Authorisation regulations**

Thank you!