SOCIO-ECONOMIC ANALYSIS METHOD

CLASSIFICATION OF SIGNIFICANT WATER RESOURCES IN THE MOKOLO AND MATLABAS CATCHMENTS: LIMPOPO WMA AND CROCODILE (WEST) AND MARICO WMA

26 November 2012

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Socio-economic analysis: Purpose

- To link:
  - The value and condition of the water resource
  - To the economy
- And then evaluate scenarios to:
  - Assist in the assessment of potential economic, social and ecological tradeoffs to be made
- In order to:
  - Understand the implications of different Management Classes

Objectives of this presentation

- To provide an overview of the economy of the Croc-West Marico WMA (Part 1)
  - Obtain input from on possible data gaps
- To present the methodology to be followed in linking the production economy to ecosystems (Part 2)
  - Obtain advice on methodology
  - Obtain input on future scenarios

WRCS: 7 Step Classification

Step 1: Delineate the units of analysis and describe the status quo of the water resource or water resources;

Step 2: Link the socio-economic and ecological value and condition of the water resource or water resources;

Step 3: Quantify the ecological water requirements and changes in non-water quality ecosystem goods, services and attributes;

Step 4: Determine an ecologically sustainable base configuration scenario;

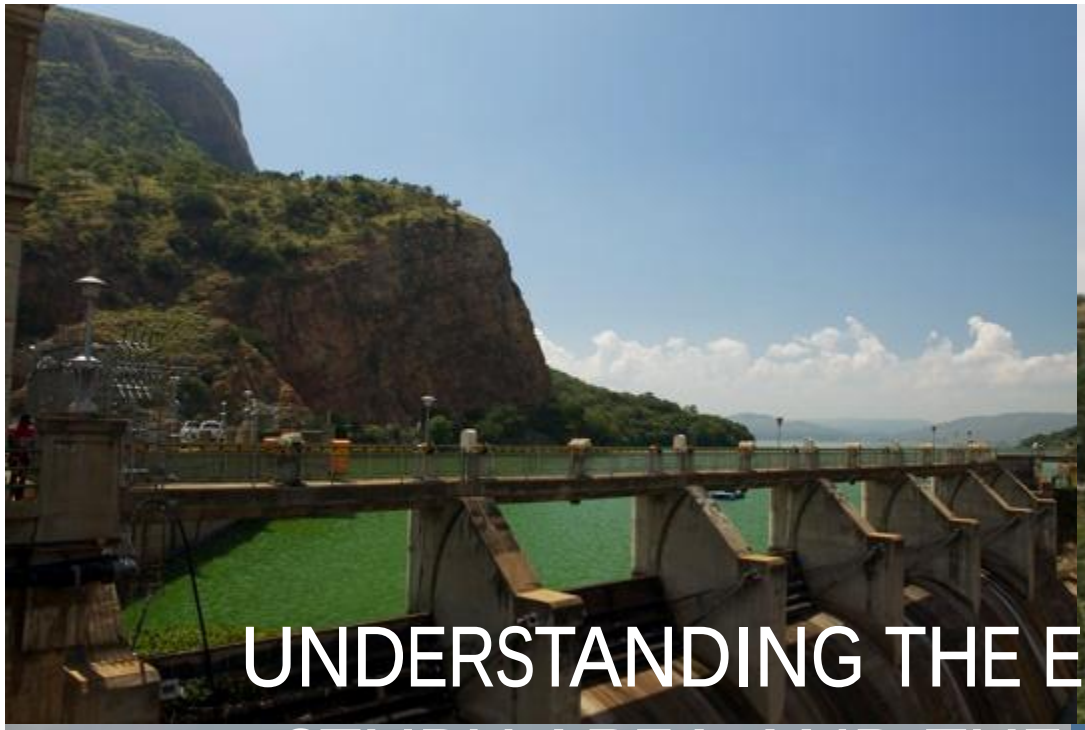
Step 5: Evaluate scenarios within the integrated water resource management process;

Step 6: Evaluate the scenarios with stakeholders; and

Step 7: Gazette and implement the class configuration

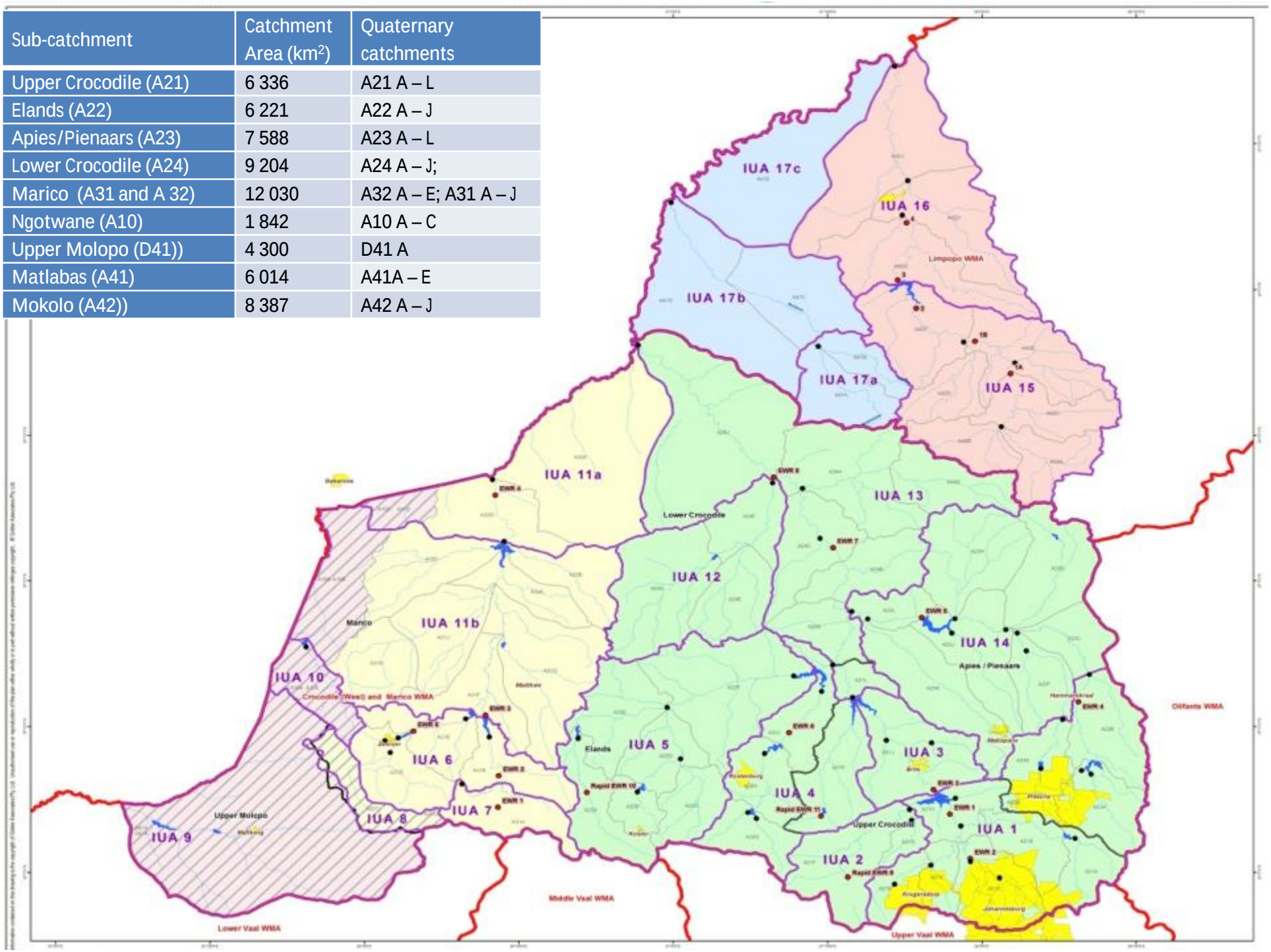
Presenters

- Part 1: Kyle Harris
- Part 2: Jackie Crafford



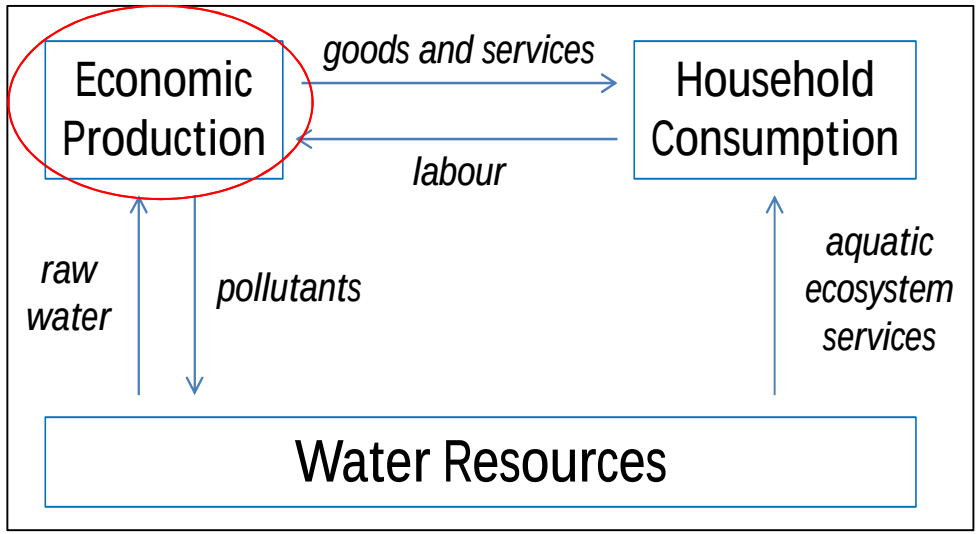
UNDERSTANDING THE ECONOMY OF THE STUDY AREA AND THE ROLE OF WATER RESOURCES IN THE ECONOMY

Sub-catchment	Catchment Area (km^2)	Quaternary catchments
Upper Crocodile (A21)	6 336	A21 A – L
Elands (A22)	6 221	A22 A – J
Apies/Pienaars (A23)	7 588	A23 A – L
Lower Crocodile (A24)	9 204	A24 A – J;
Marico (A31 and A 32)	12 030	A32 A – E; A31 A – J
Ngotwane (A10)	1 842	A10 A – C
Upper Molopo (D41))	4 300	D41 A
Matlabas (A41)	6 014	A41A – E
Mokolo (A42))	8 387	A42 A – J



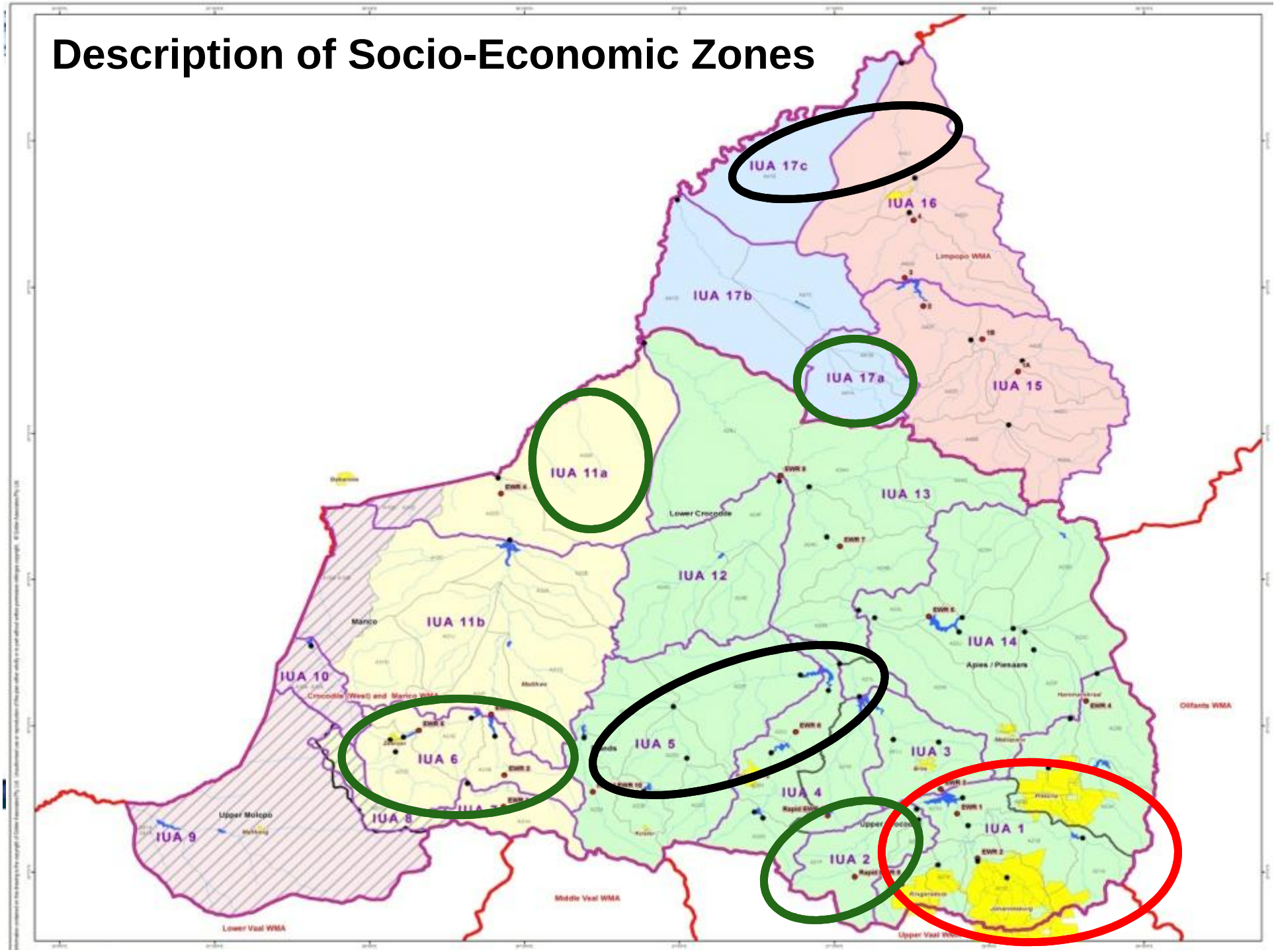
Key economic actors

- Producers (firms)
- Households
- Ecosystems (aquatic ecosystems or Water Resources)



Producers (firms): Produces economic goods and services; creates jobs

Description of Socio-Economic Zones



Socio-economic description per IUA

IUA	Quaternary catchment	Socio-economic Description	Area (Km^2)	Population (Census 2001)	Number of Households (Census 2001)
1	A21A-E; A21H; A23A; A23B; A23D and A23E	IUA 1 contains the Metropolitan Municipalities of Tshwane (full), Johannesburg (part) and Ekurhuleni (part) and the town of Krugersdorp. The IUA constitutes a large portion of South Africa's commercial, financial, industrial and manufacturing sectors and is an important contributor to National GDP.	5 076	2 945 840	1 023 421
2	A21F and A21G	The IUA contains the Magaliesburg conservation area as well as the Cradle of Humankind World Heritage Site. Both important for tourism and conservation activities. There are also agricultural activities in the IUA.	1 161	9 899	2 962
3	A21J	The area downstream from Hartbeespoort Dam is an important agricultural area and considerable tourism activities exist on the Crocodile River.	1 150	171 775	51 170
4	A21K; A22G; A22H; A22J	Rustenburg is the main town found in this IUA. The western limb of the Bushveld Igneous Complex (BIC), the largest platinum group metals (PGM) deposit worldwide, is found in this IUA. There is also substantial granite mining in the area.	2 533	315 239	95 068
5	A22A -F	The IUA contains the towns of Koster and Swartruggens. Major socio-economic activities include agriculture, private owned conservation areas and some tourism activities.	4 546	175 045	49 857
6	A31B; A31D and A31E	The IUA contains the town of Zeerust and Groot Marico. Major socio-economic activities include agriculture, light manufacturing, conservation and tourism. There have been rumours of nickel mining prospecting rights granted in the area.	1 901	23 620	6 440
7	A31A	The IUA is largely rural in nature with game farms and commercial agriculture present. The area is an important tourism area due to the dolomitic eyes found there.	632	2 901	868

Socio-economic description per IUA

IUA	Quaternary catchment	Socio-economic Description	Area (Km^2)	Population (Census 2001)	Number of Households (Census 2001)
7	A31A	The IUA is largely rural in nature with game farms and commercial agriculture present. The area is an important tourism area due to the dolomitic eyes found there.	632	2 901	868
8	A31C	The IUA is largely rural in nature with game farms and commercial agriculture present. The area is an important tourism area due to the dolomitic eyes found there.	485	3 550	946
9	D41A	The IUA contains the town of Mafikeng, which is the capital of the North West Province and is an important regional hub. Socio-economic activities include commercial agriculture, dry-land and subsistence farming and limited tourism activities.	4 298	307 111	78 267
10	A10A	The IUA is largely rural in nature and contains dry land and subsistence agriculture.	558	50 605	11 478
11a	A31F-J; A32A-C and A10B	This large IUA is largely rural in nature and contains a portion of the former Bophuthatswana Homeland. Major socio-economic activities in the IUA include: commercial agriculture, dry-land agriculture and subsistence farming. Local communities in the area highly dependent on the ecosystem services delivered by the Groot Marico River.	6 682	137 272	34 038
11b	A10C; A32D; A32E	This IUA is largely rural in nature and contains a portion of the former Bophuthatswana Homeland. Major socio-economic activities in the IUA include: commercial agriculture, dry-land agriculture and subsistence farming. Local communities in the area highly dependent on the ecosystem services delivered by the Groot Marico River.	3 613	10 887	3 557

Socio-economic description per IUA

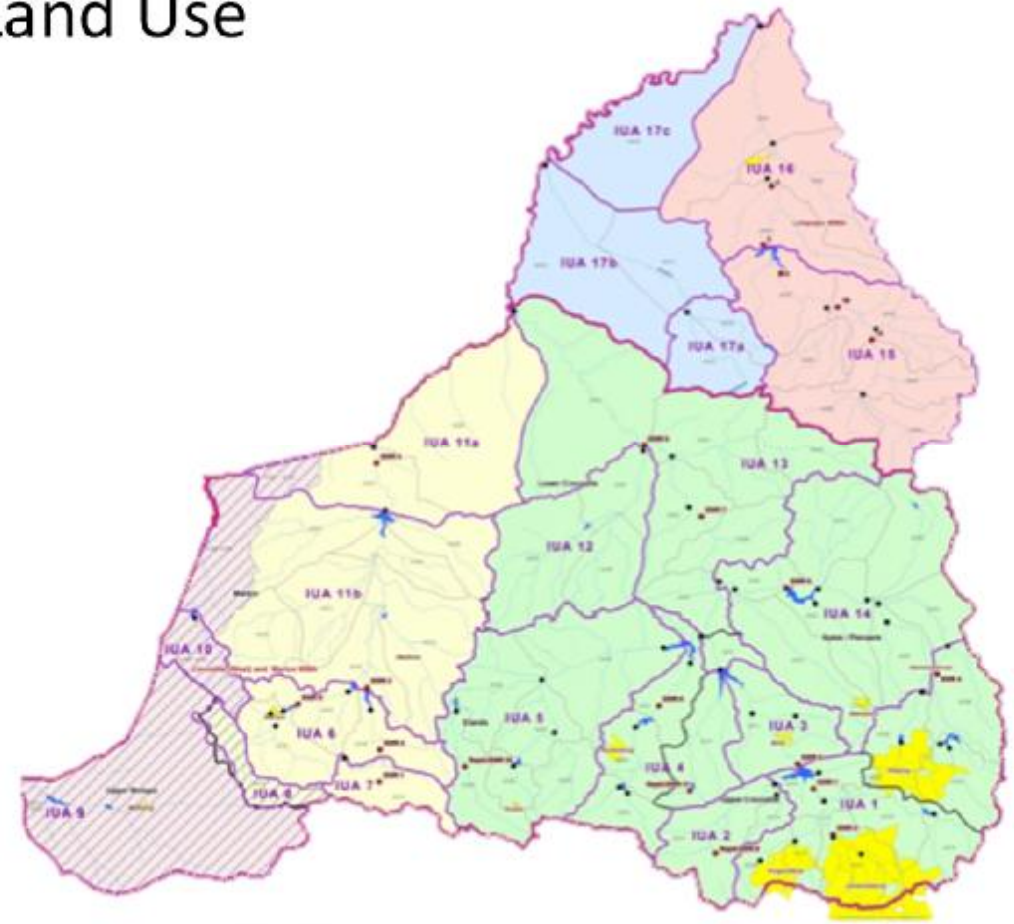
IUA	Quaternary catchment	Socio-economic Description	Area (Km^2)	Population (Census 2001)	Number of Households (Census 2001)
12	A24D-F	The IUA contains the town of Thabazimbi. Mining is an important sector in this IUA, with iron ore and andalusite significant examples. The IUA is also important as a hunting area and the Marakele National Park is found here.	2 605	87 275	24 097
13	A21L: A24A-C and A24G-J	This large IUA is primarily agricultural in nature and contains commercial agriculture, dry-land and subsistence agriculture. In addition, the area has large hunting and private conservation areas.	6 806	65 701	22 792
14	A23C; A23F-L	This IUA contains the peri-urban areas of Mabopane and a portion of Hammanskraal, which have large populations. The IUA contains commercial agriculture, dry-land and subsistence agriculture. The Moretele flood plain is important from an ecosystems services point of view as it supports grazing in the dry season. The floodplain is also an important birding area. The IUA also contains the Borakalalo Game Reserve.	5 455	1 122 195	291 519
15	A42A-F	The IUA is largely comprised of a mix between conservation and game farming. The IUA contains some commercial agriculture. Tourism, in the form of hunting and game viewing, is an important sector in this IUA. At present, a pipeline is being built from the Mokolo Dam to supply the Grootgeluk Coal Mine in IUA 16.	4 319	27 240	7 410
16	A42G-J	The IUA contains the town of Lephalale. The area is an important future energy hub and contains the Matimba power station as well as the Medupi power station, which is under construction. The Grootgeluk Coal Mine is in the IUA and several new coalmines have been earmarked for the future. The IUA is also important from a game farming and conservation perspective and contains the D'Nyala Nature Reserve.	4 074	27 604	9 670
17a	A41A-B	The IUA is largely comprised of conservation and contains the Marakele Nature Reserve.	1 049	1 573	760

Socio-economic description per IUA

IUA	Quaternary catchment	Socio-economic Description	Area (Km^2)	Population (Census 2001)	Number of Households (Census 2001)
17a	A41A-B	The IUA is largely comprised of conservation and contains the Marakele Nature Reserve.	1 049	1 573	760
17b	A41C-D	The major economic activities in this IUA are stock or game farming and tourism in the form of hunting.	3 020	4 529	1 422
17c	A41E	Game farming is the main economic activity in the IUA. The Steenbokpan area that has been earmarked for future coal mining is in this IUA.	1 925	2 887	1 061

Land Use

Land Use Category (CSIR 2002)	Area (ha)
Cultivation	38 129
Degraded	889 825
Mines	20 329
Natural	4 711 112
Plantations	3 520
Urban Built-up	234 685
Water bodies	277 765
Grand Total	6 175 364



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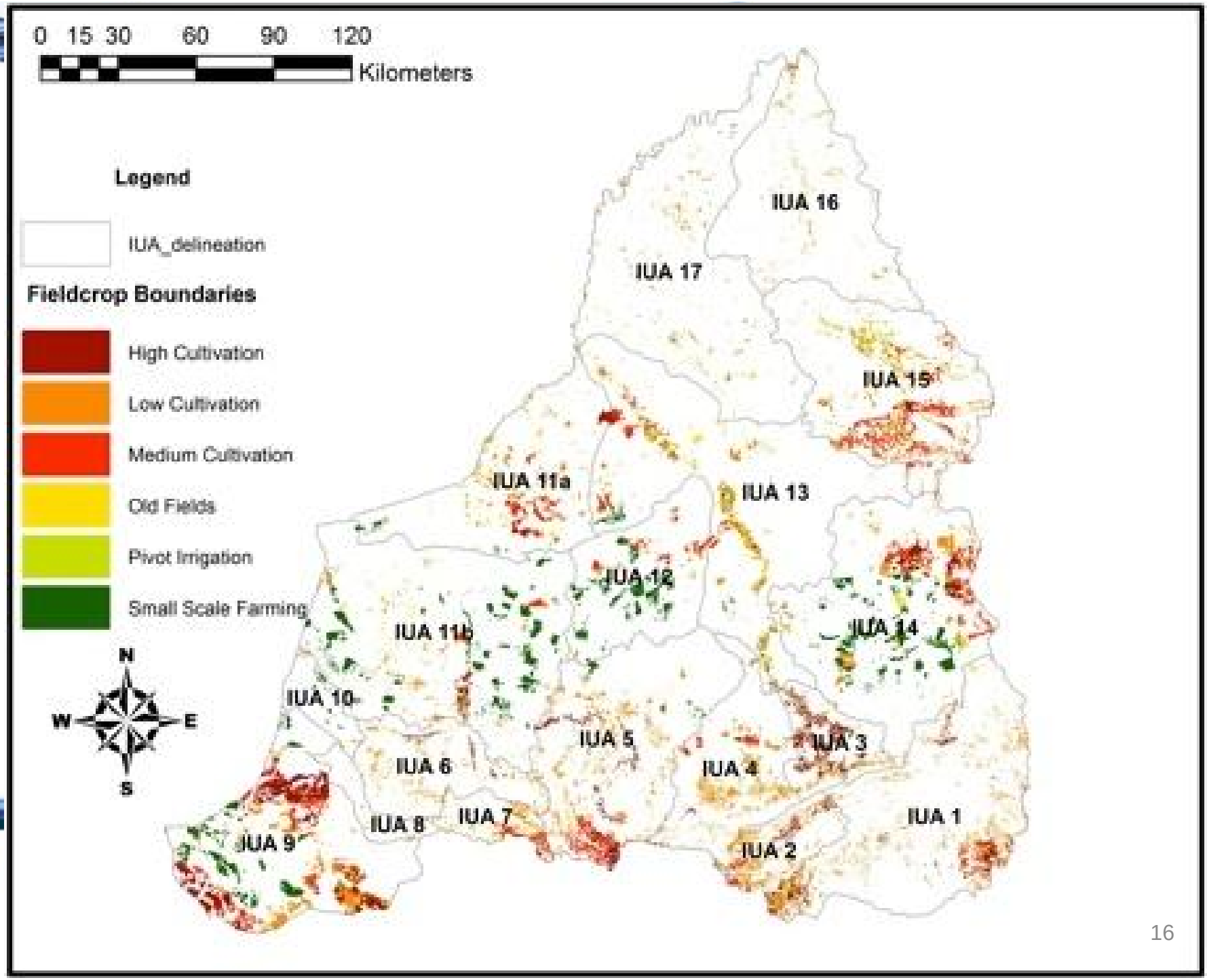
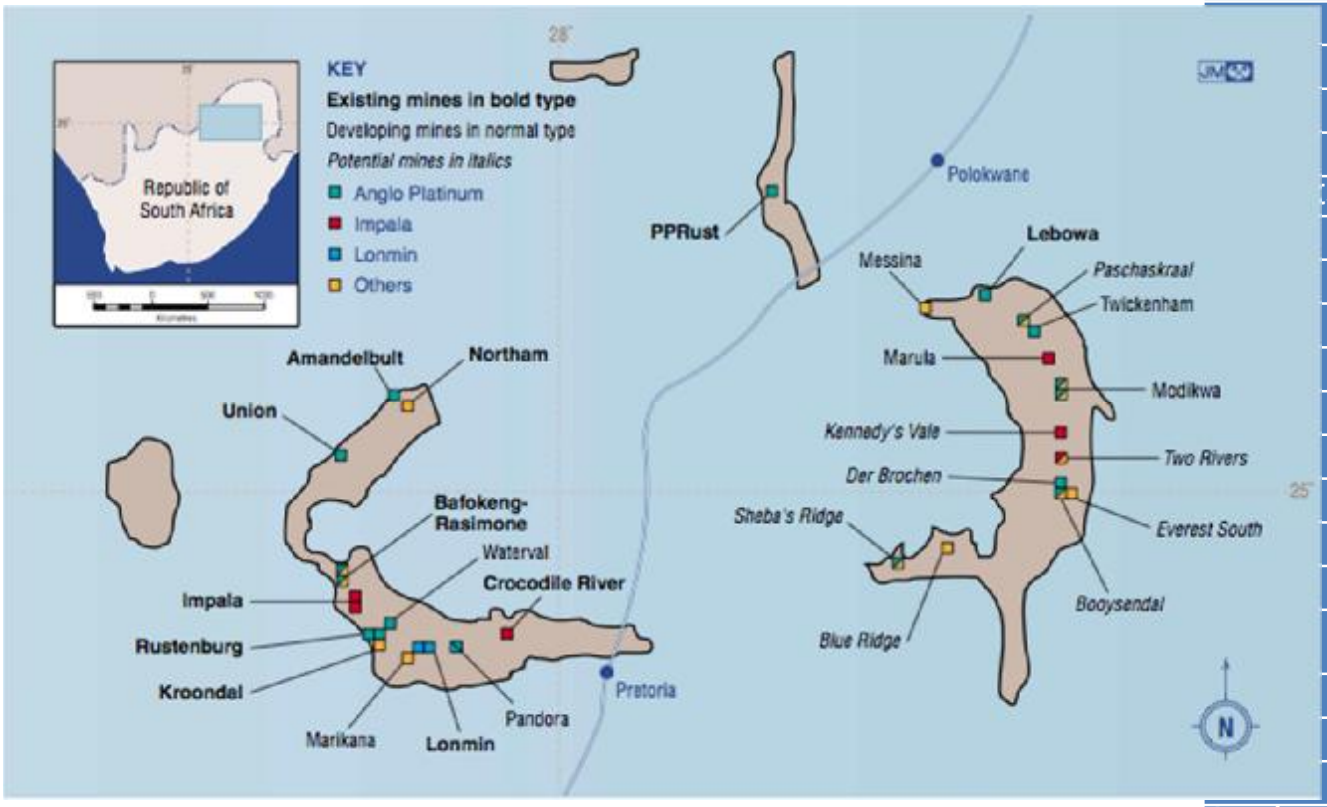
Agriculture

Agriculture Category (DAFF 2010)	Area (ha)
High Cultivation	103 421
Low Cultivation	201 428
Medium Cultivation	131 619
Old Fields	18 148
Pivot Irrigation	53 065
Small Scale Farming	113 124
Grand Total	620 806

Crop Type (Stats SA 2007)	Area (ha)	
	Dryland	Irrigation
Maize	73 259	20 282
Wheat	6 313	10 036
Sunflower	29 121	2 717
Soyabean	1 739	2 529
Groundnut	587	786
Dry beans	22	-
Potatoes	719	-
Tomatoes	543	-
Onions	618	-
Pumpkins	216	-
Oranges	1 882	-
Beetroot	115	-
Carrots	1 359	-
Cabbage	523	-
Greenbeans	35	-
Total	117 049	36 350


0 15 30 60 90 120
Kilometers
Legend
IUA_delineation
Fieldcrop Boundaries
High Cultivation
Low Cultivation
Medium Cultivation
Old Fields
Pivot Irrigation
Small Scale Farming
N
W
E
S
IUA 16
IUA 17
IUA 15
IUA 11a
IUA 13
IUA 12
IUA 11b
IUA 14
IUA 10
IUA 5
IUA 3
IUA 6
IUA 4
IUA 8
IUA 7
IUA 1
IUA 9
IUA 2

Mining: Platinum



Company	Mine	PGM (oz)
Aquarius	Kroondal	207 473
	Marikana	52 962
	CTRP	2 438
	Platinum Mile	11 417
	Sub Total	274 290
ts	Bathopele Mine	243 200
	Khomanani Mine	179 700
	Thembelani Mine	205 900
	Khuseleka Mine	245 500
	Siphumelele Mine	163 900
	Tumela Mine	543 000
	Dishaba Mine	291 100
	Union Mine	515 400
	Union North Mine	184 800
	Union South Mine	330 700
	Western Limb Tailings Retreatment	65 500
	Kroondal	445 900
	Marikana	92 100
	Sub Total	3 506 700
Implats	Impala	1 854 200
	Sub Total	1 854 200
Lonmin	Marikana	1 303 597
	Pandora	48 199
	Sub Total	1 351 796
Northam	Zondereinde	244 957
	Sub Total	244 957
	Grand Total	7 231 943

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All sectors	Total (R'million)
Agriculture	27,000
Platinum Mining	45,000
Other Mining	58,000
Manufacturing - food	93,000
Manufacturing - other	464,000
Electricity and water	25,000
Building and Other Construction	66,000
Trade	34,000
Accommodation	19,000
Transport	59,000
Communication	38,000
Insurance	57,000
Real Estate	101,000
Business Services	33,000
Community, Social and Personal Services	53,000
GDP	549,000

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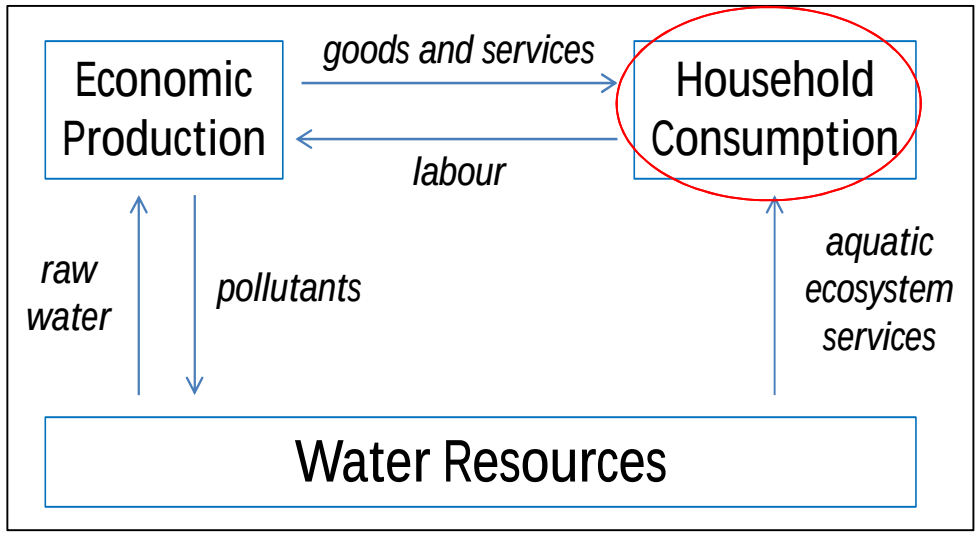
PRELIMINARY

Key economic actors

- Producers (firms)
- Households
- Ecosystems (aquatic ecosystems or Water Resources)



Households:
The people of the area

IUA	Population
IUA 1	2 945 840
IUA 2	9 899
IUA 3	171 775
IUA 4	315 239
IUA 5	175 045
IUA 6	23 620
IUA 7	2 901
IUA 8	3 550
IUA 9	307 111
IUA 10	50 605
IUA 11a	10 887
IUA 11b	137 272
IUA 12	87 275
IUA 13	65 701
IUA 14	1 122 195
IUA 15	27 240
IUA 16	27 604
IUA 17	8 989
Total	5 492 746

IUA Population

StatsSA 2001

Census Data

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Household Income

Income Category	Household	%
Very Poor (no income-R 9 600)	632 979	36,87
Poor (R9 601-R 38 400)	554 975	32,33
Tolerable (R 38 401-R 76 800)	186 596	10,87
Comfortable (R 76 801-R 153 600)	143 523	8,36
Wealthy (>R 153 601)	198 720	11,58
Total number of households	1 716 789	100,00

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Employment Status

Employment Category	Number
Employed	1 738 991
Unemployed	908 692
Not economically active	1 236 941

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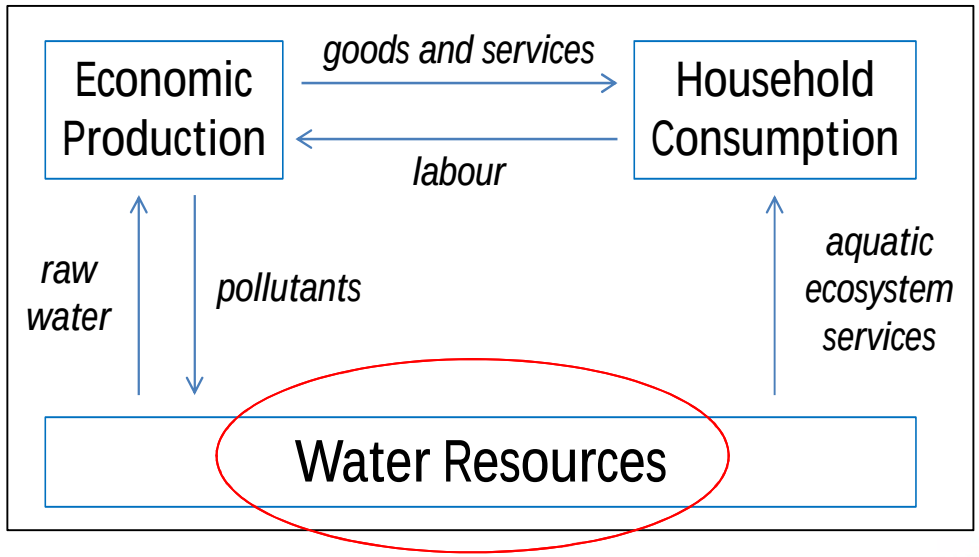
Employment by sector

	Sectoral employment
Agriculture	3.9%
Mining	5.8%
Manufacturing	10.9%
Electricity and water	0.6%
Buyilding and Construction	5.5%
Trade	15.5%
Transport and communication	5.1%
Financial intermediation; insurance; real estate and business services	13.5%
Community; social and personal services	19.7%
Private households	10.3%
Other	9.1%

Key economic actors

- Producers (firms)
- Households
- Ecosystems (aquatic ecosystems or Water Resources)

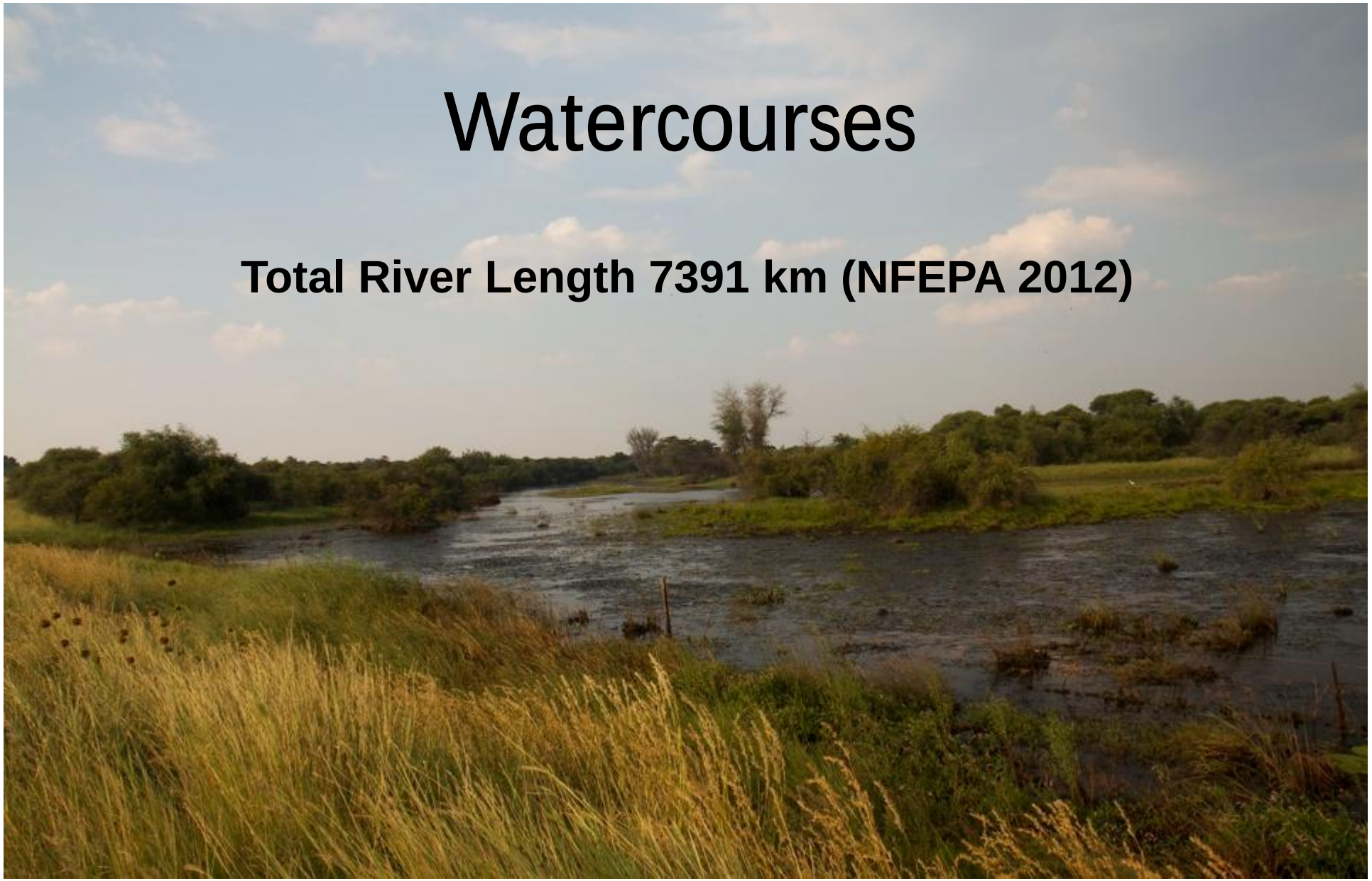


National Water Act (1998) defines water resources:

- Watercourse (rivers, springs, natural channels, wetlands, lakes & dams);
- Surface water;
- Aquifers.

Watercourses

Total River Length 7391 km (NFEPA 2012)



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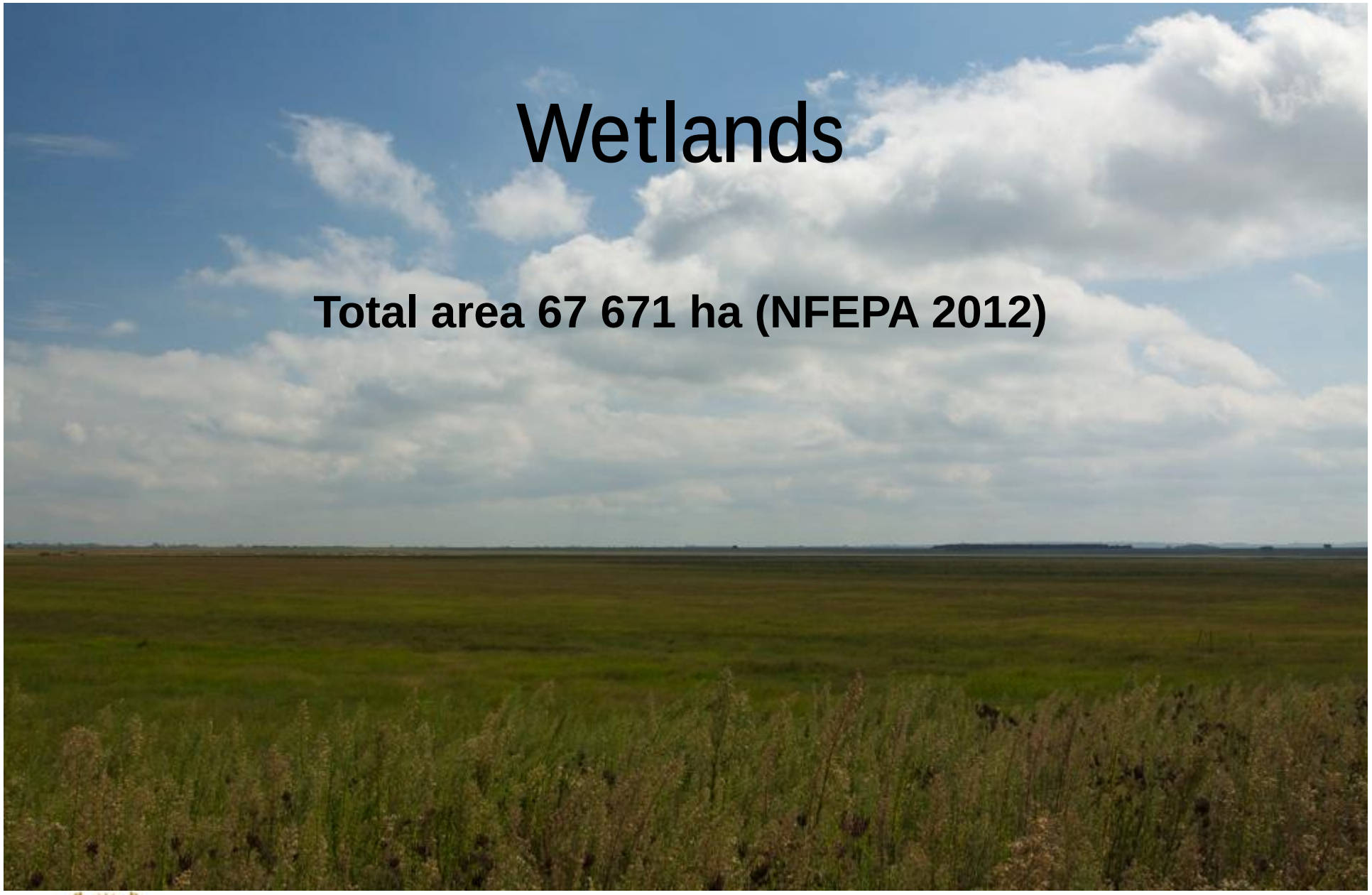
Wetlands

Total area 67 671 ha (NFEPA 2012)



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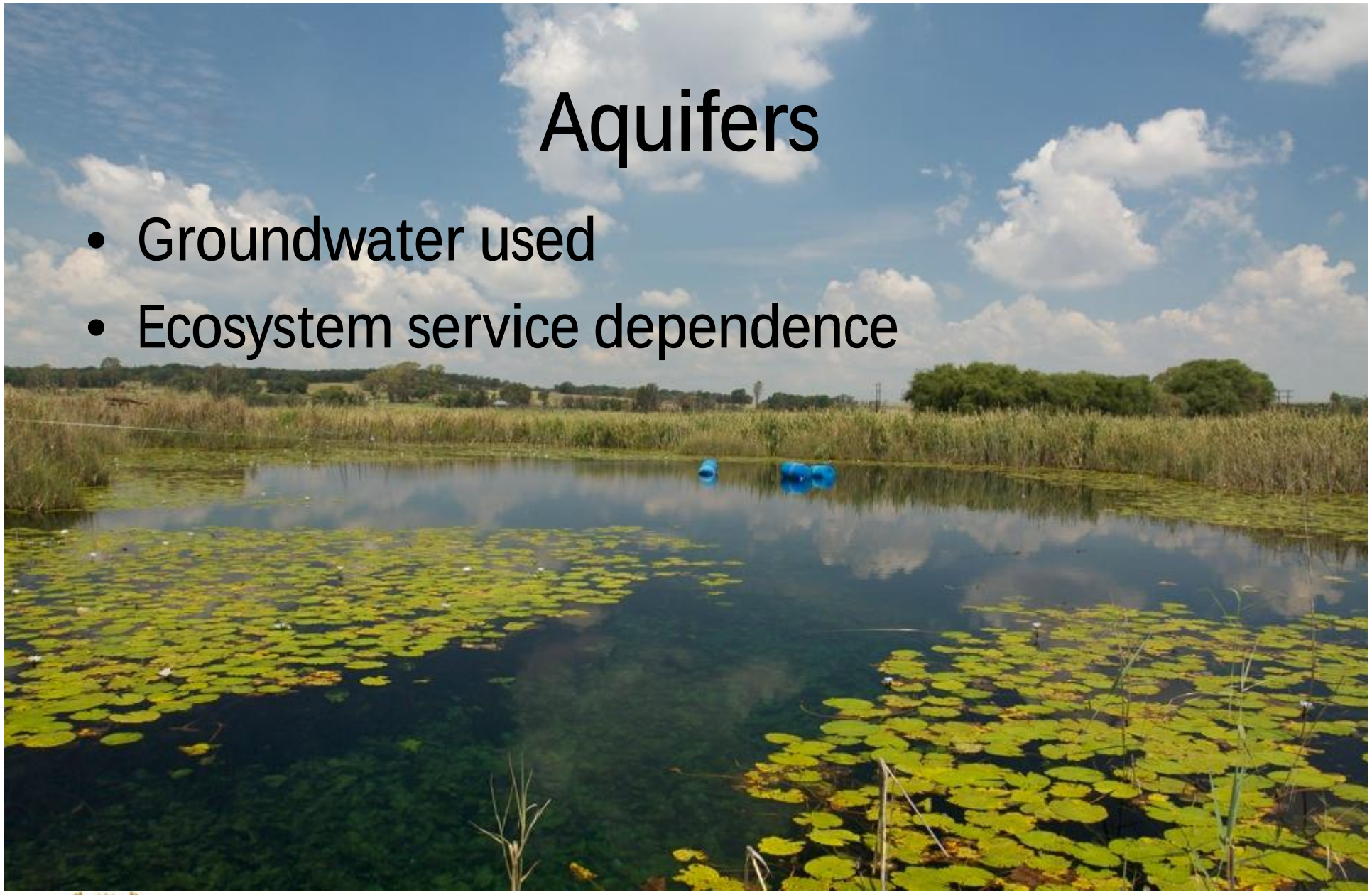
Aquifers

- Groundwater used
- Ecosystem service dependence



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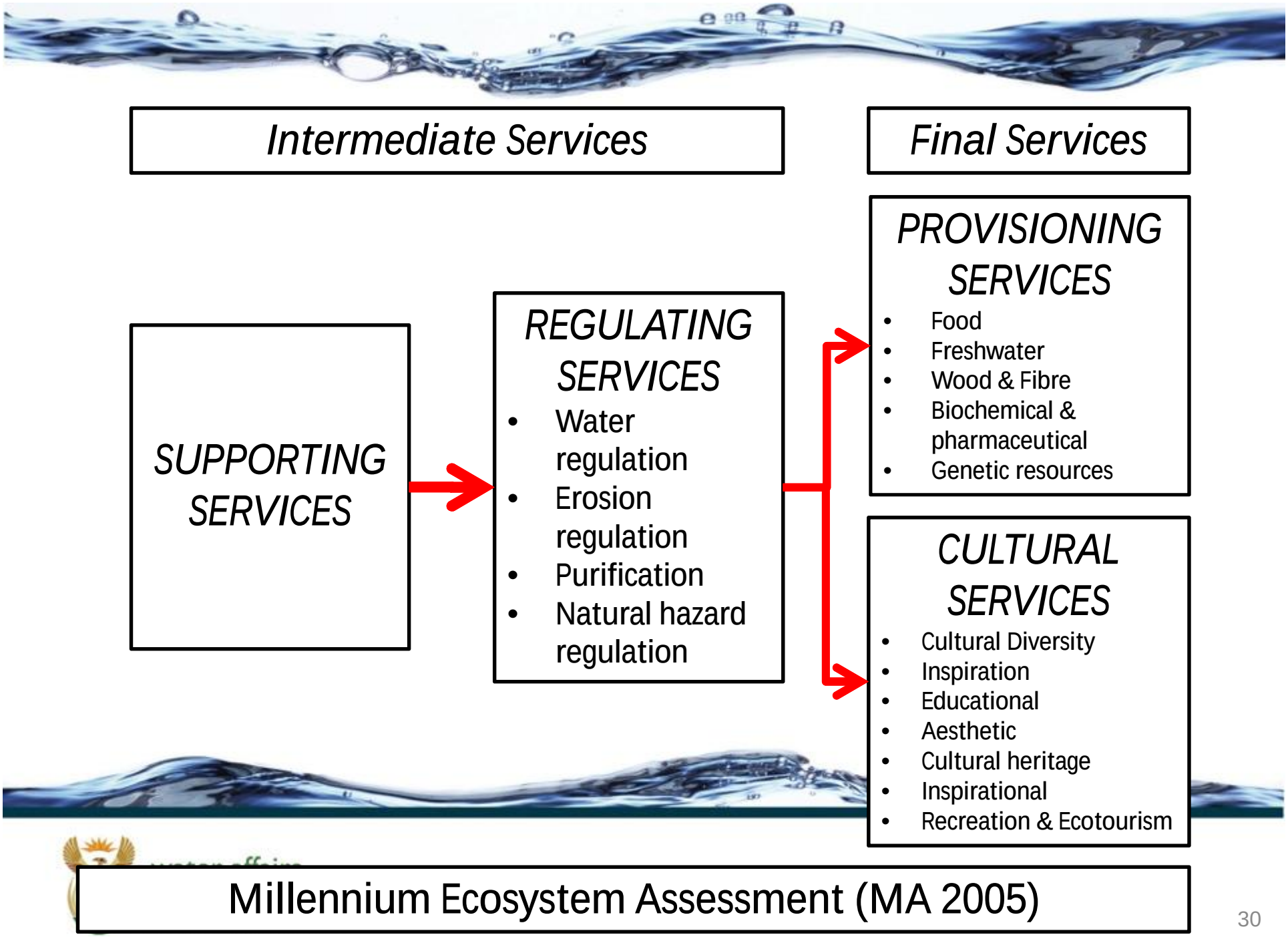
WATER USE: the GDP, expressed as Value Added (VAD), of the water sector

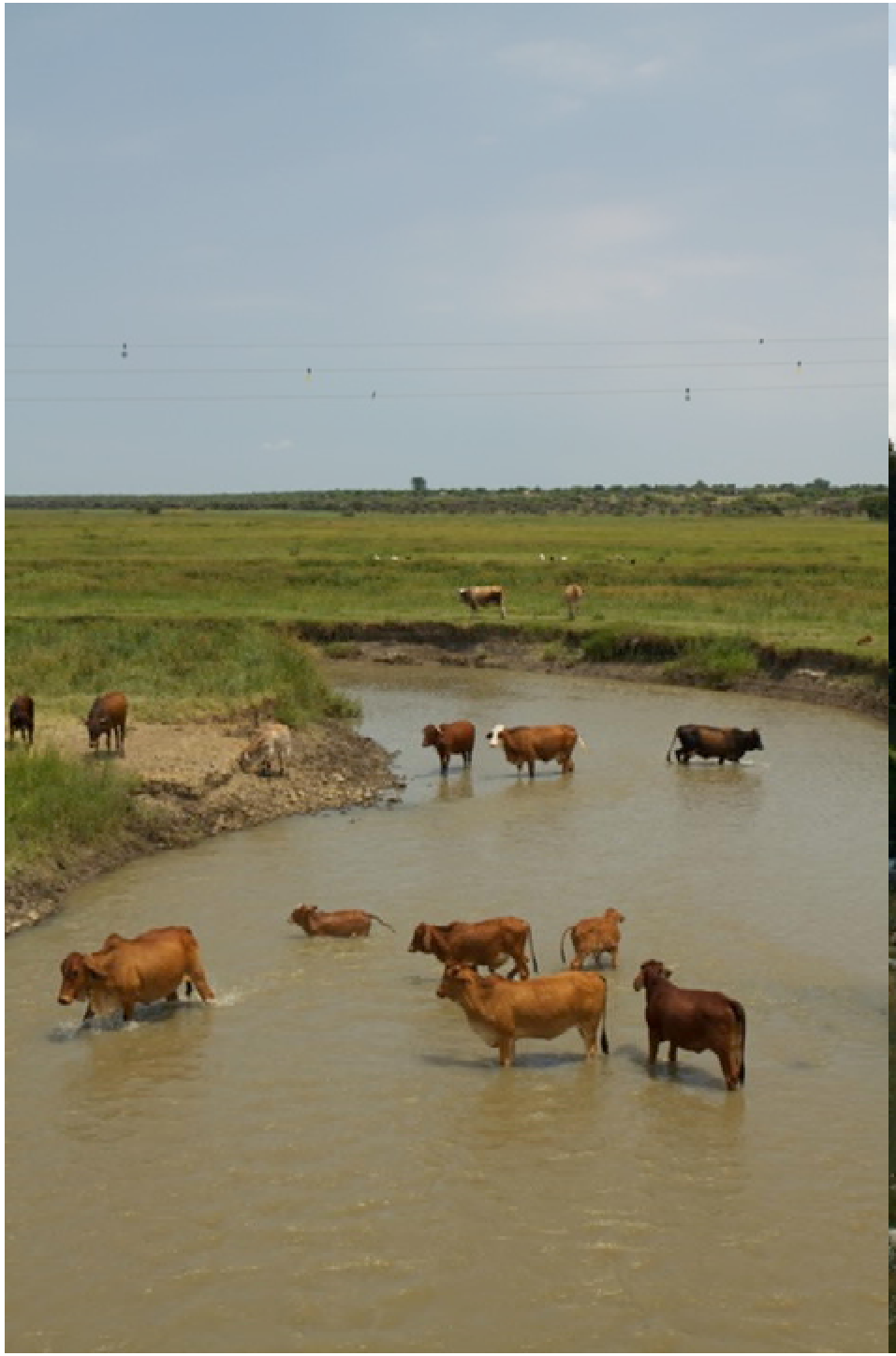
User Sector	Agriculture		Urban	Rural	Industrial	Mining		Power Generation	Total
	Irrigation	Livestock Farming				Platinum	Other		
Water Requirements (R'million)	509	12	630	48	212	100	43	41	1 602
VAD estimate (R'million)	2 688	1 694	10 952	834	425 406	76 392	27 491	2 866	549 323

PRELIMINARY

Ecosystem services

- The benefits humans receive from water resources
- Ecosystems are ecological assets that yield a range of ecosystem services which benefit people
- Millennium Ecosystems Assessment (2005)
  - A sound and well established framework for the assessment of ecosystem services


Intermediate Services
Final Services
SUPPORTING SERVICES
REGULATING SERVICES
• Water regulation
• Erosion regulation
• Purification
• Natural hazard regulation
PROVISIONING SERVICES
• Food
• Freshwater
• Wood & Fibre
• Biochemical & pharmaceutical
• Genetic resources
CULTURAL SERVICES
• Cultural Diversity
• Inspiration
• Educational
• Aesthetic
• Cultural heritage
• Inspirational
• Recreation & Ecotourism
Millennium Ecosystem Assessment (MA 2005)

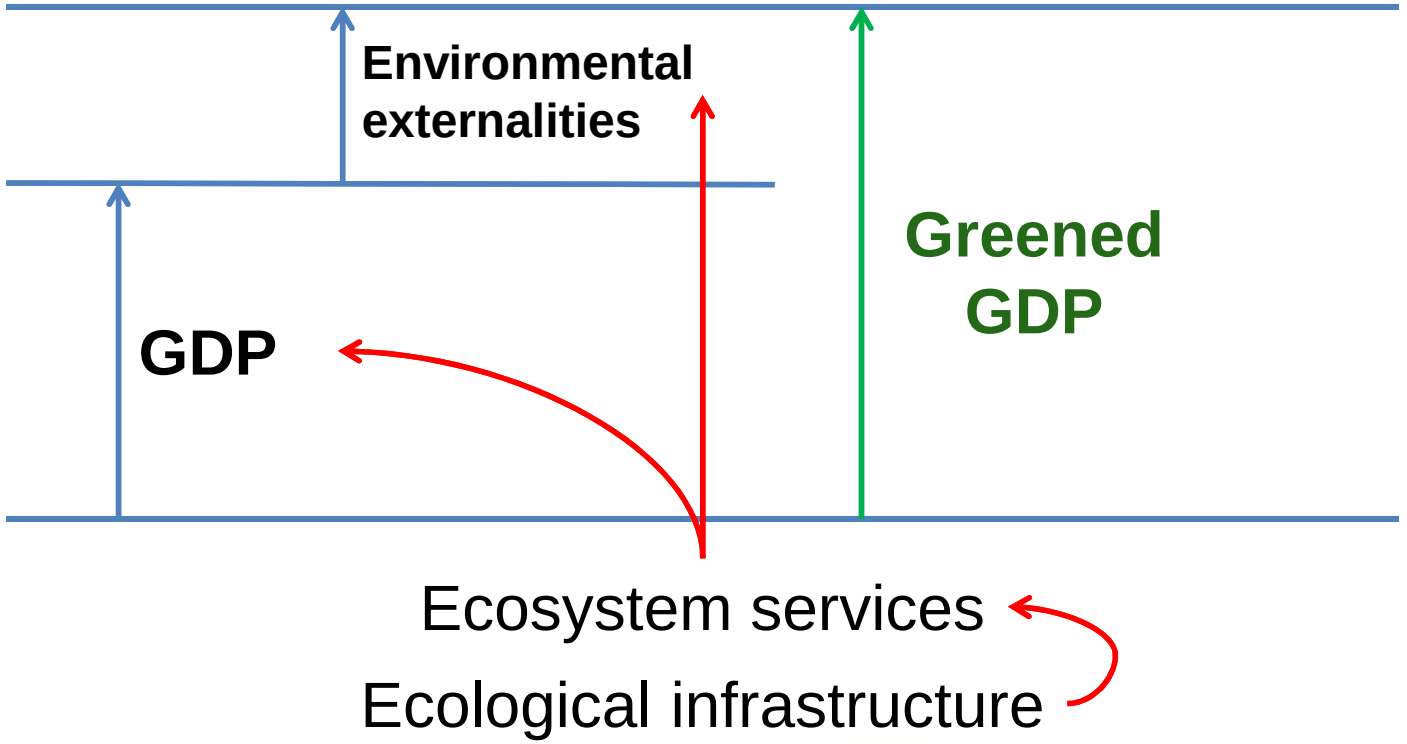


Ecosystem services

Ecosystem Service	R' million
Domestic water use	359.2
Grazing	4.2
Livestock watering	622.5
Harvested products	371.9
Tourism	395.1
Recreation	61.7
Aesthetic value	27.3
Education	0.5
Total	1,850

PRELIMINARY

Ecosystem Services and GDP

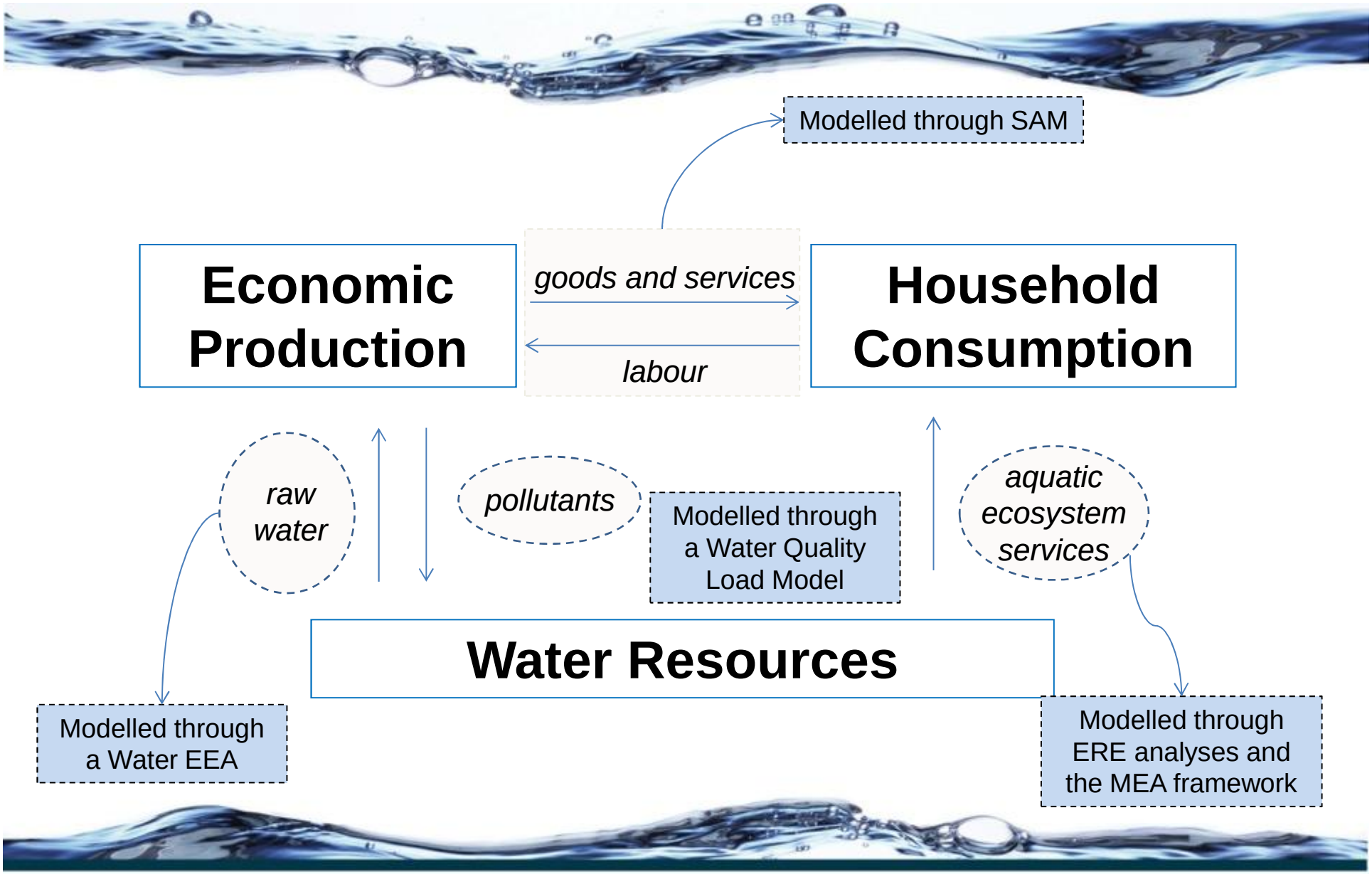


Discussion

Part 2

PRESENTATION ON SOCIO-ECONOMIC METHODS TO BE APPLIED

"linking the ecosystem to the economy"



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The nature of economic value

- Welfare economics
- Human welfare =
  + Consumption of private market G&S
  + Consumption of government G&S
  + Consumption of non-market G&S

Human welfare

- Anthropocentric focus:
  - Does not preclude a concern for the survival and well-being of other species:
    - Use values
    - Ethical concerns

Can ecosystems be valued?

- Compensation:
  - Deals with the magnitude of trade-offs,
  - Capture trade-offs in a common unit of measurement,
  - Deals with beneficiaries.

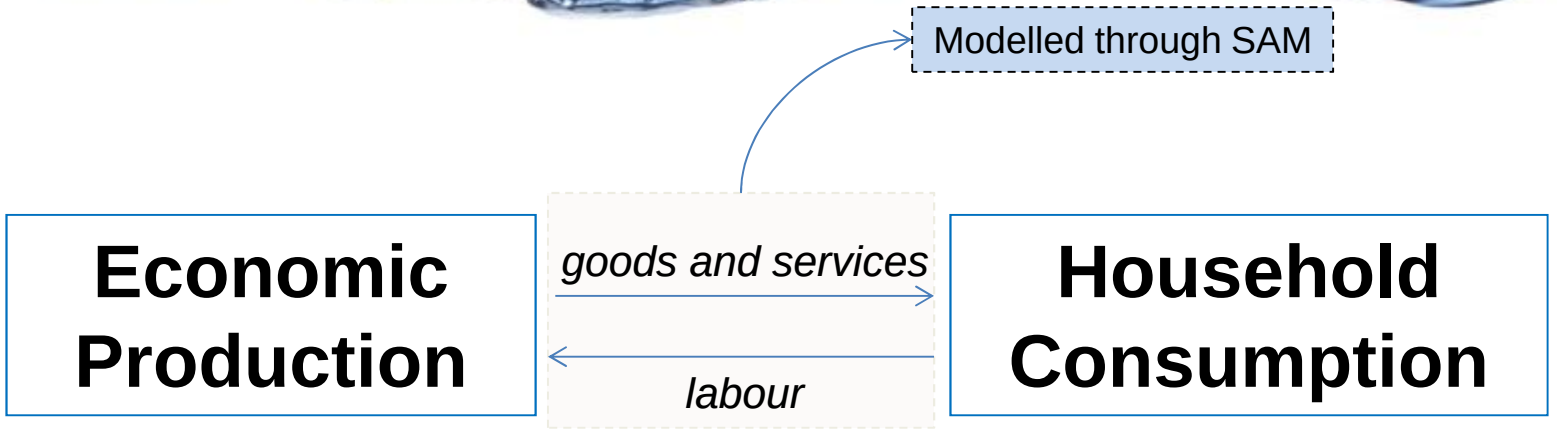
How?

Economic Production

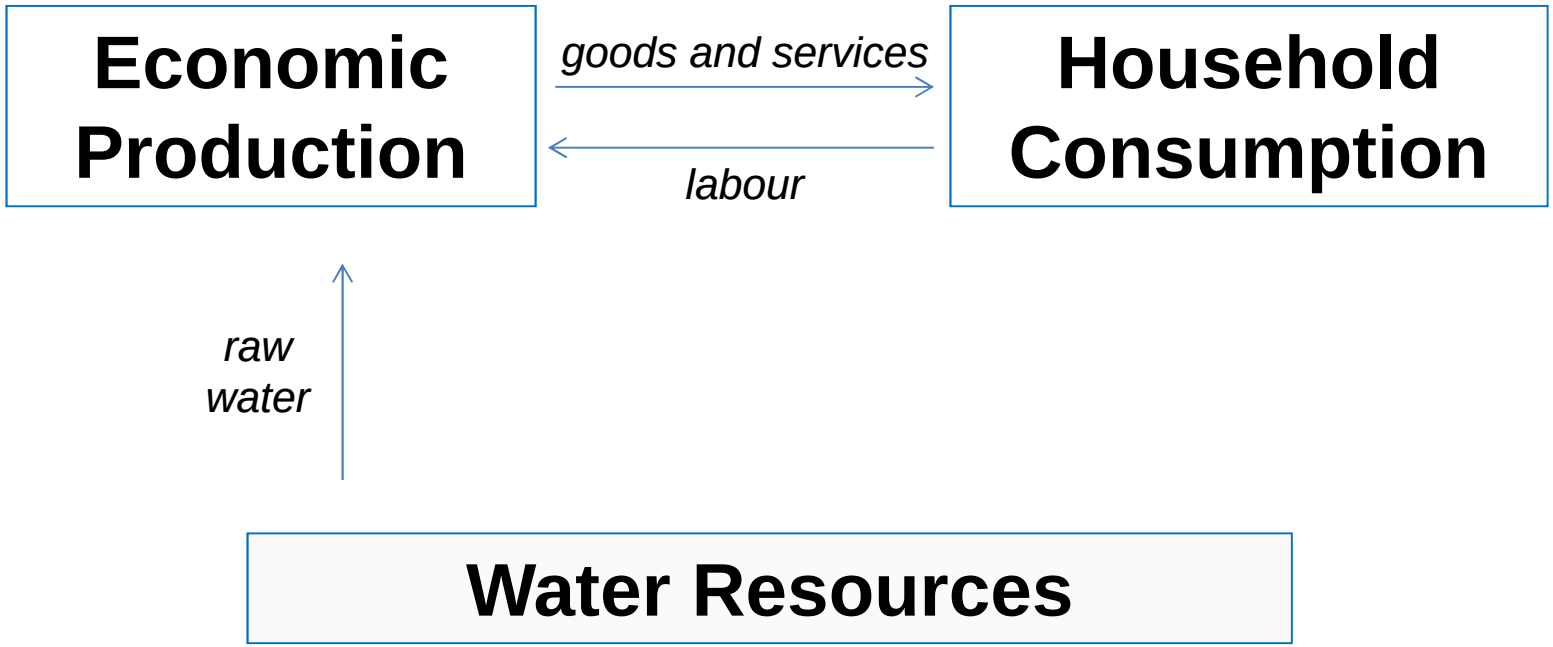
goods and services →

← *labour*

Household Consumption



- System of National Accounts, Standard Industrial Classification
- Statistics SA, DBSA
- GDP, Supply and Use Tables, Social Accounting Matrix



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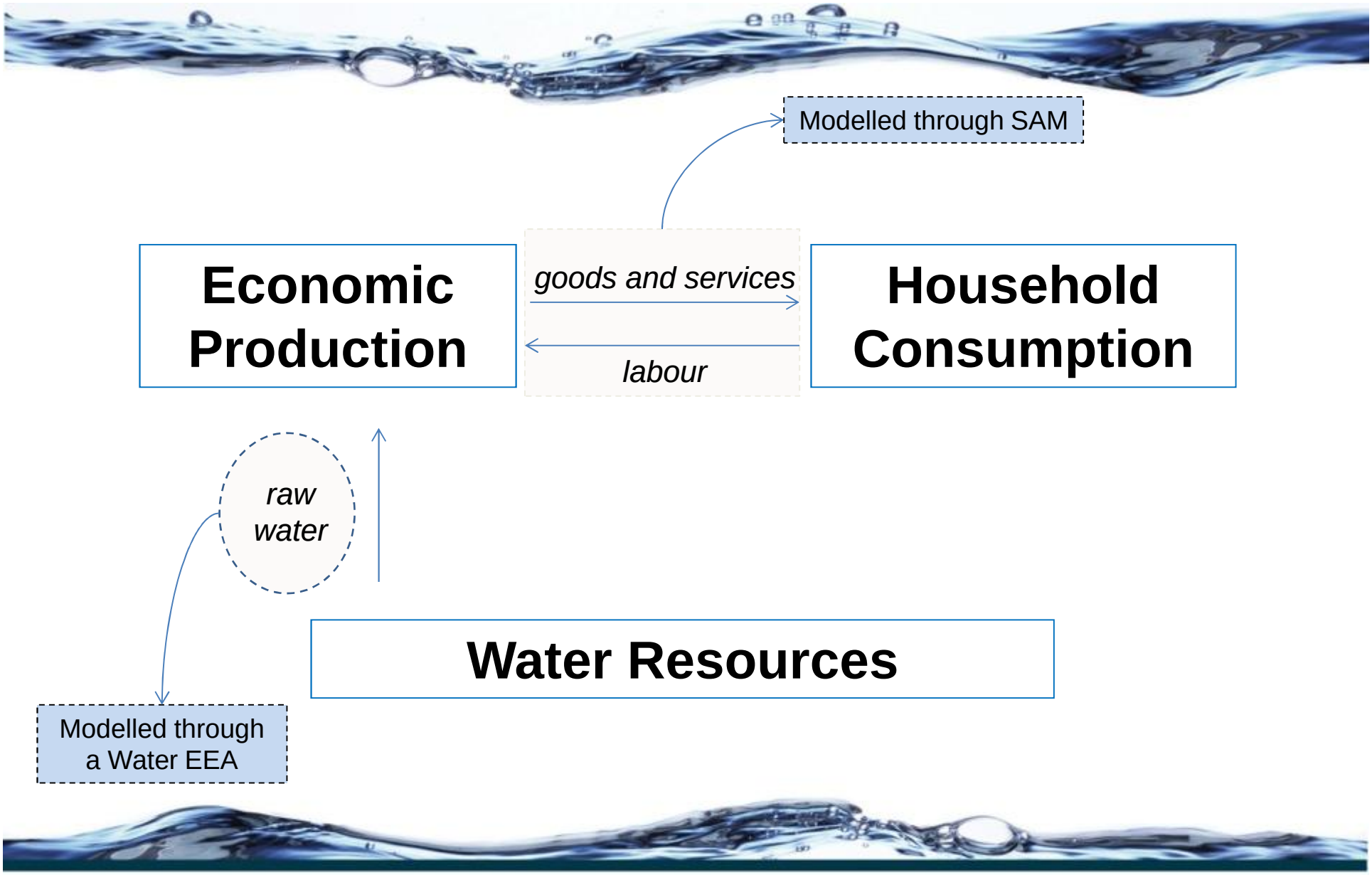

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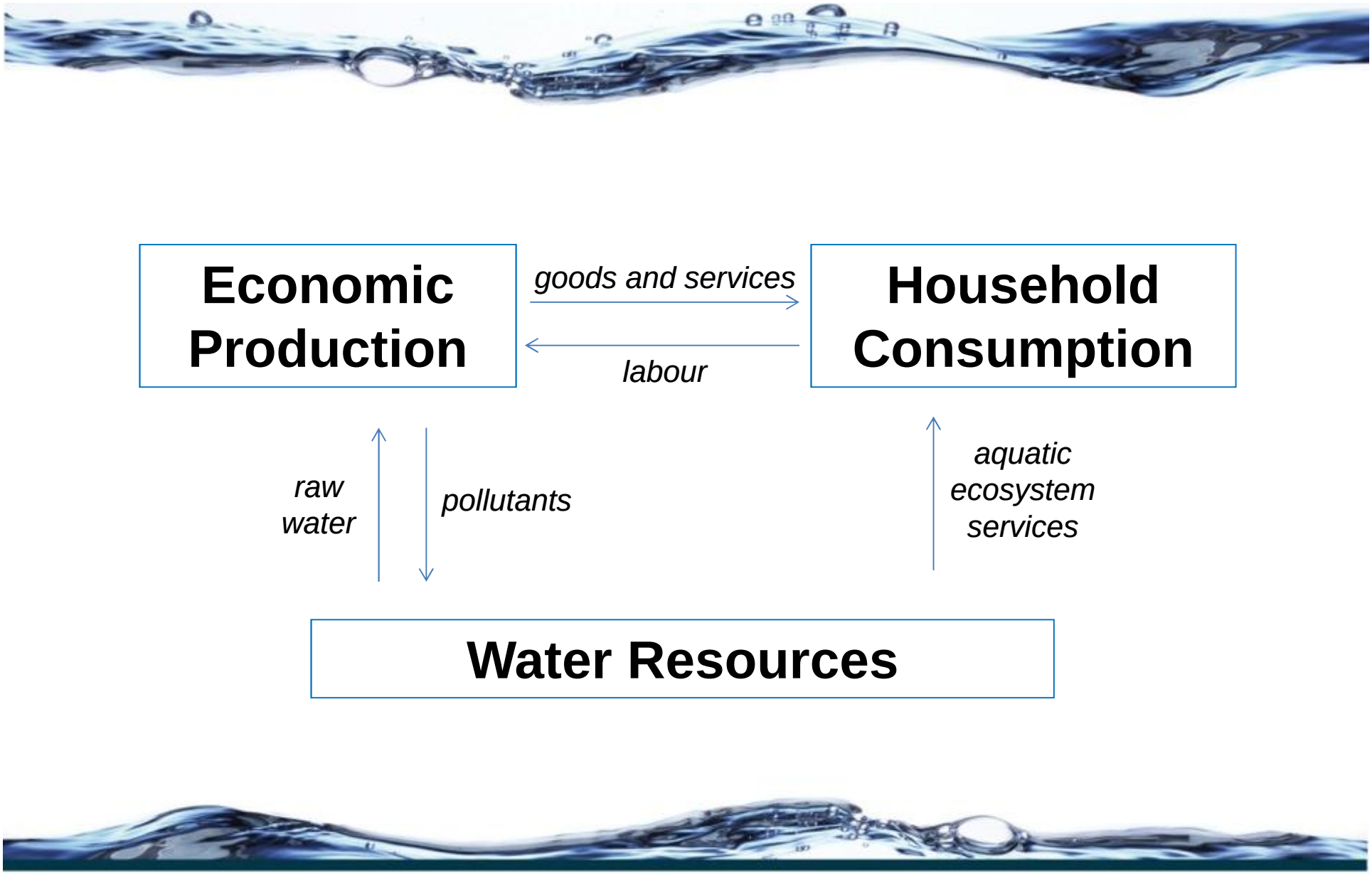
- SEEAW (UN), Stats SA
- DWA Reconciliation strategy



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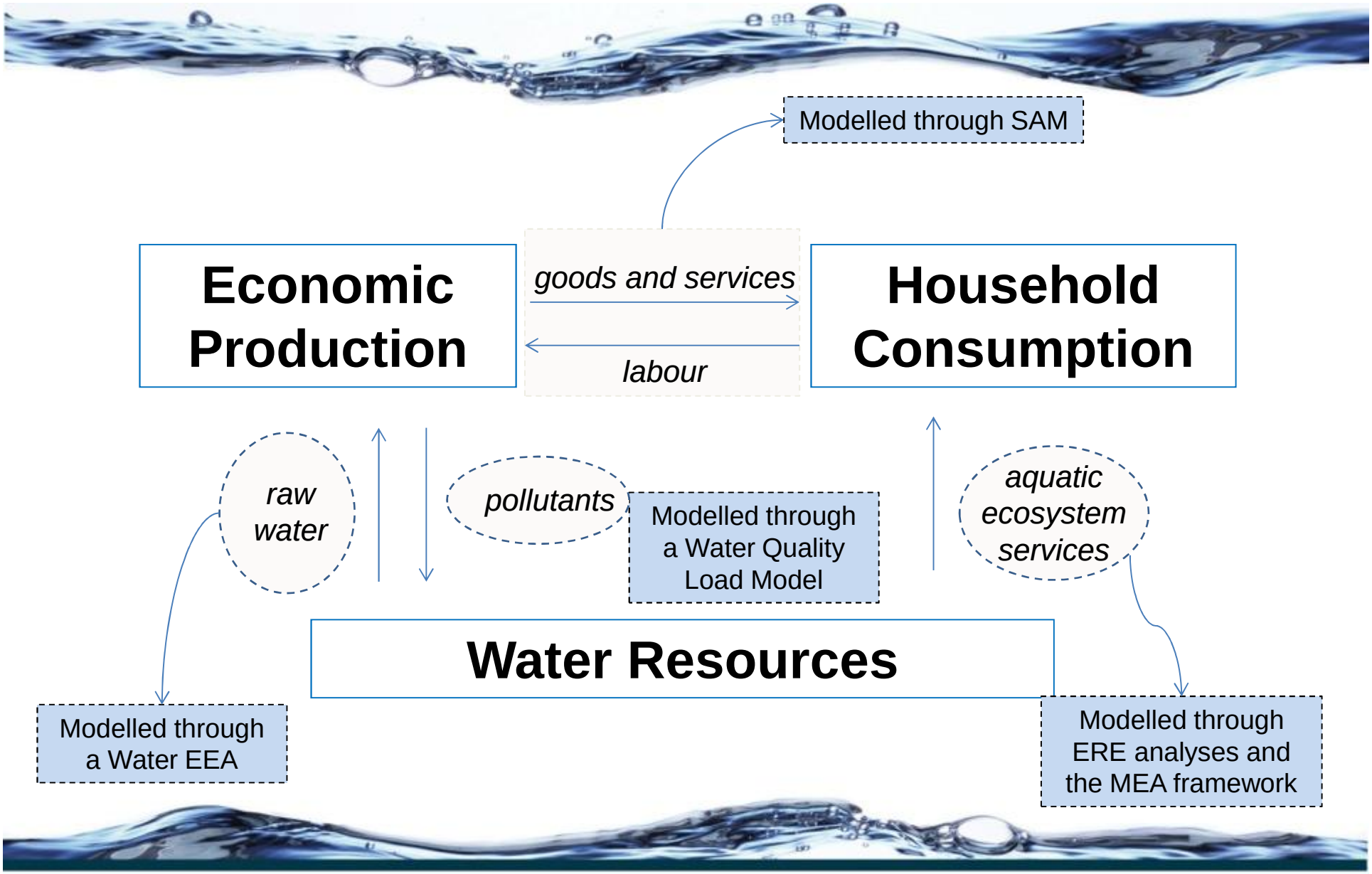

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Best practices

- DWA WRCS Guideline
- Economic production and household consumption:
  - DBSA economic models (SAMs) for Limpopo and Mpumalanga (2009)
  - Production models
- Water Resources:
  - DWA Reconciliation Strategy
  - EWR Classification outputs
  - Stats SA Environmental Economic Accounts for Water (2008)
  - DWA study on Ecosystem Services (2010)
  - WRC Guidelines for evaluation of ecosystem services (2010)

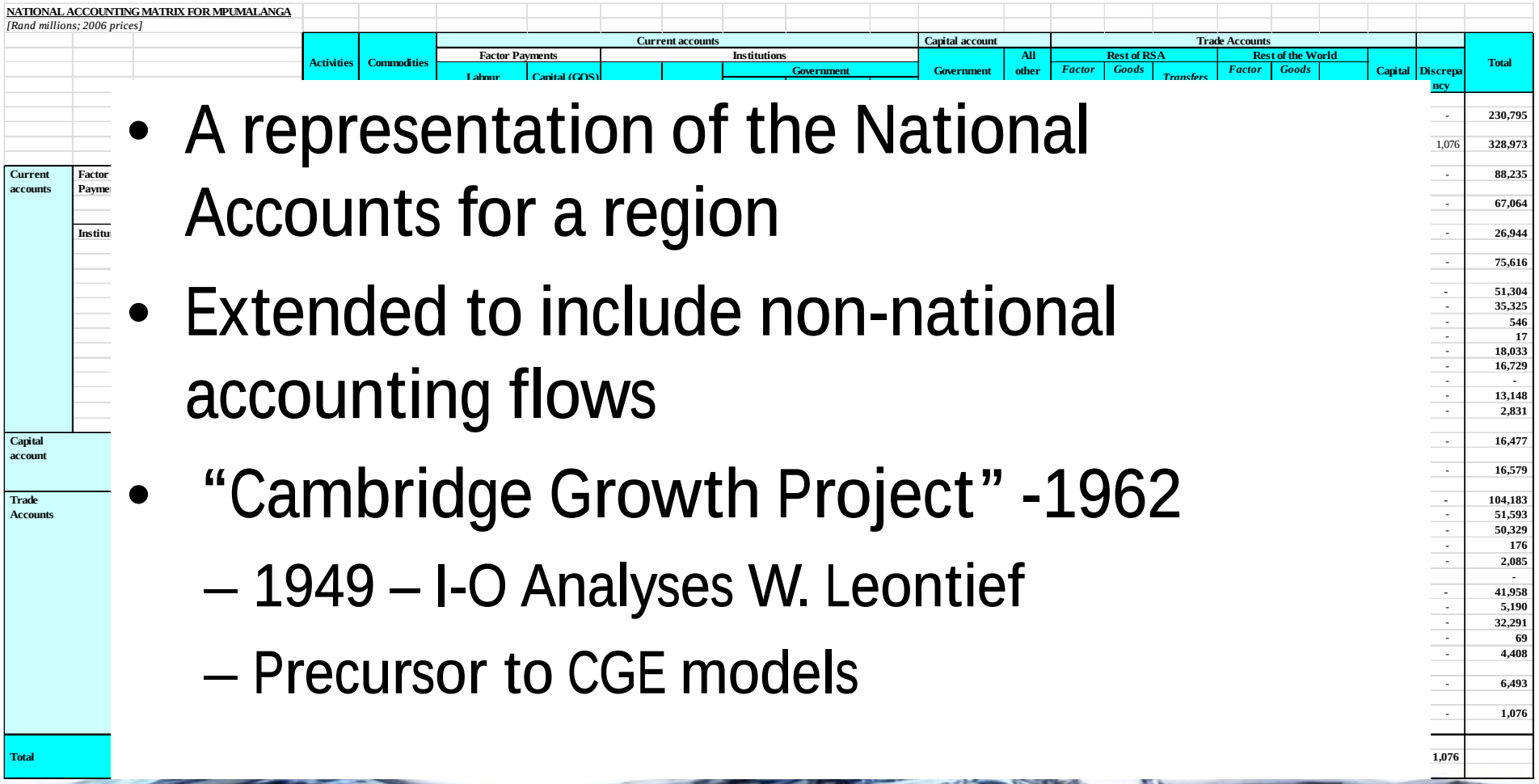
Best practices

- Water Resources
  - WRC Guidelines for evaluation of ecosystem services
  - UN SEEAW (Water EEA)
  - Millennium Ecosystem Assessment (MEA) Framework: ecosystem services and Environmental & Resource Economic (ERE) analyses
  - Polluter pays principle (MCA method - DWA Waste Discharge Charge System)
- Evidence based

Advisory

- Prof Charles Perrings, Arizona State Univ
- Prof Rashid Hassan, Univ Pretoria
- Dr Kirk Hamilton, World Bank
- Dr Thierry de Oliveira, UNEP

Social Accounting Matrix



NATIONAL ACCOUNTING MATRIX FOR MPUMALANGA
[Rand millions; 2006 prices]

	Activities	Commodities	Current accounts: Factor Payments: Labour	Current accounts: Factor Payments: Capital (GOS)	Current accounts: Institutions	Current accounts: Institutions: Government	Capital account: Government	Capital account: All other	Trade Accounts: Rest of RSA: Factor	Trade Accounts: Rest of RSA: Goods	Trade Accounts: Rest of RSA: Transfers	Trade Accounts: Rest of the World: Factor	Trade Accounts: Rest of the World: Goods	Trade Accounts: Rest of the World	Trade Accounts: Capital	Discrepancy	Total
Current accounts: Factor Payme																-	230,795
																1,076	328,973
Current accounts: Institu																-	88,235
																-	67,064
																-	26,944
																-	75,616
																-	51,304
																-	35,325
																-	546
																-	17
																-	18,033
																-	16,729
																-	-
																-	13,148
																-	2,831
Capital account																-	16,477
																-	16,579
Trade Accounts																-	104,183
																-	51,593
																-	50,329
																-	176
																-	2,085
																	-
																-	41,958
																-	5,190
																-	32,291
																-	69
																-	4,408
																-	6,493
																-	1,076
Total																1,076	

- A representation of the National Accounts for a region
- Extended to include non-national accounting flows
- "Cambridge Growth Project" -1962
  - 1949 – I-O Analyses W. Leontief
  - Precursor to CGE models

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Environmental Economic Accounts
- Water Hybrid Account -

- A representation of the water transactions for a region
- Links to SAM
- UN System for Environmental-Economic Accounting for Water
  - – 1991 – Rio Summit
  - – 2012 –SEEAW
  - – Continuous development

Water Flow Accounts: Input-output Table for RSA (2000)

		Environment						Distribution					Production									
		Athmosphere and sea	Natural MAR	Surface water yield	Ground water	Soil water	Ecological reserve	DWAF (Total Yield)	Irrigation Boards	Water Boards	Municipalities	ROW and other WMA's	Agriculture: Dryland & irrigation	Agriculture: Livestock	Agriculture: Plantation	Agriculture: Total	Mining	Electricity	Other Bulk Industrial	Other Commercial & Industrial	Domestic - Urban	Domestic - Rural	Domestic - Total	Total
Environment	Athmosphere & sea		49,040		1,088	55,400										-							-	105,528
	Natural MAR (including storage)	29,633		19,357												-							-	49,040
	Surface water (including reserve)						9,545	9,812							428	428							-	19,785
	Groundwater							1,088								-							-	1,088
	Soil water												45,000		10,400	55,400							-	55,400
	Ecological reserve	9,545														-							-	9,545
Distribution	DWAF (available total yield)	186							7,920	4,094	116	170		313		313							-	12,799
	Irrigation Boards												7,920			7,920							-	7,920
	Water Boards										**3042**					-	**388.0**	**297.0**	**367.0**				-	4,094
	Municipalities							1,223								-				1,199	1,698	261	1,959	4,381
	ROW and other WMA's	170						-								-							-	170
Production	Agriculture	62,957	-	428	-	-	-	676	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64,061
	Dryland & Irrigation	52,244						676								-							-	52,920
	Livestock & Game	313														-							-	313
	Plantation forestry	10,400		428												-							-	10,828
	Mining	326									62					-							-	388
	Electricity	234									63					-							-	297
	Other Bulk (industrial)	238									129					-							-	367
	Other Commercial & Industrial	784									415					-							-	1,199
	Total domestic	1,405									534	-	-	-	-	-	-	-	-	-	-	-	-	1,959
	Domestic - Urban	1,144									554					-							-	1,698
	Domestic - Rural	261														-							-	261
Theoretical ecological reserve							9,545									-							-	9,545
Water Balance							186									-							-	186
Total Use (U)		105,528	49,040	19,785	1,088	55,400	9,545	12,799	7,920	4,094	4,381	170	52,920	313	10,828	64,061	388	297	367	1,199	1,698	261	1,959	338,021
Total Supply 1 (S1)		105,528	49,040	19,785	1,088	55,400	9,545	12,799	7,920	4,094	4,381	170	52,920	313	10,828	64,061	388	297	367	1,199	1,698	261	1,959	338,021
Consumption 1 (U - S1)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Supply 2 (S2) excluding evapotranspiration		105,528	49,040	19,785	1,088	55,400	9,545	12,799	7,920	4,094	4,381	170	46,440	61	10,400	56,900	97	82	162	664	910	46	956	328,610
Consumption 2 (U - S2) - economic consumption		-	-	-	-	-	-	-	-	-	-	-	6,480	252	428	7,161	291	215	205	535	788	215	1,003	9,411

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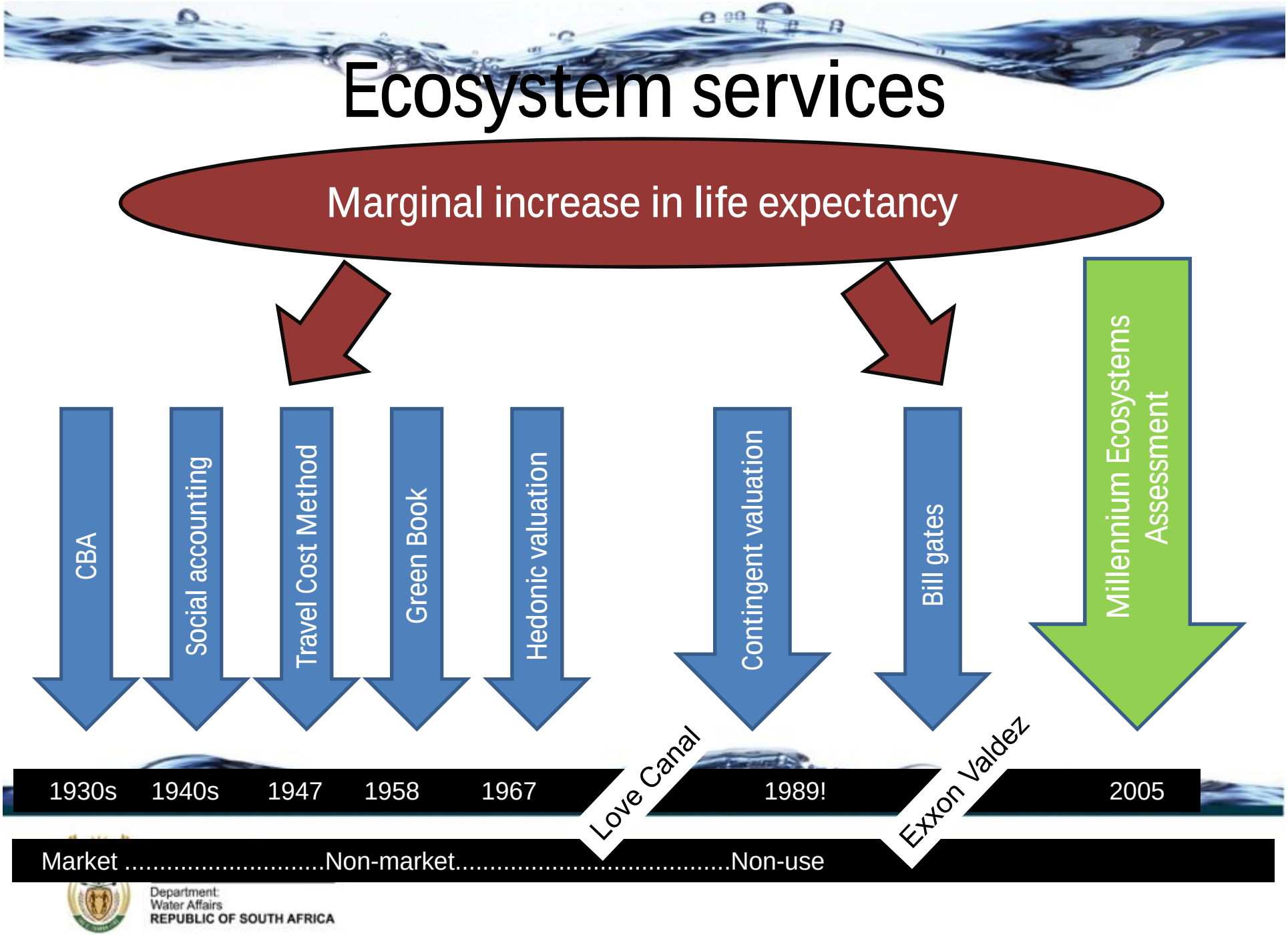
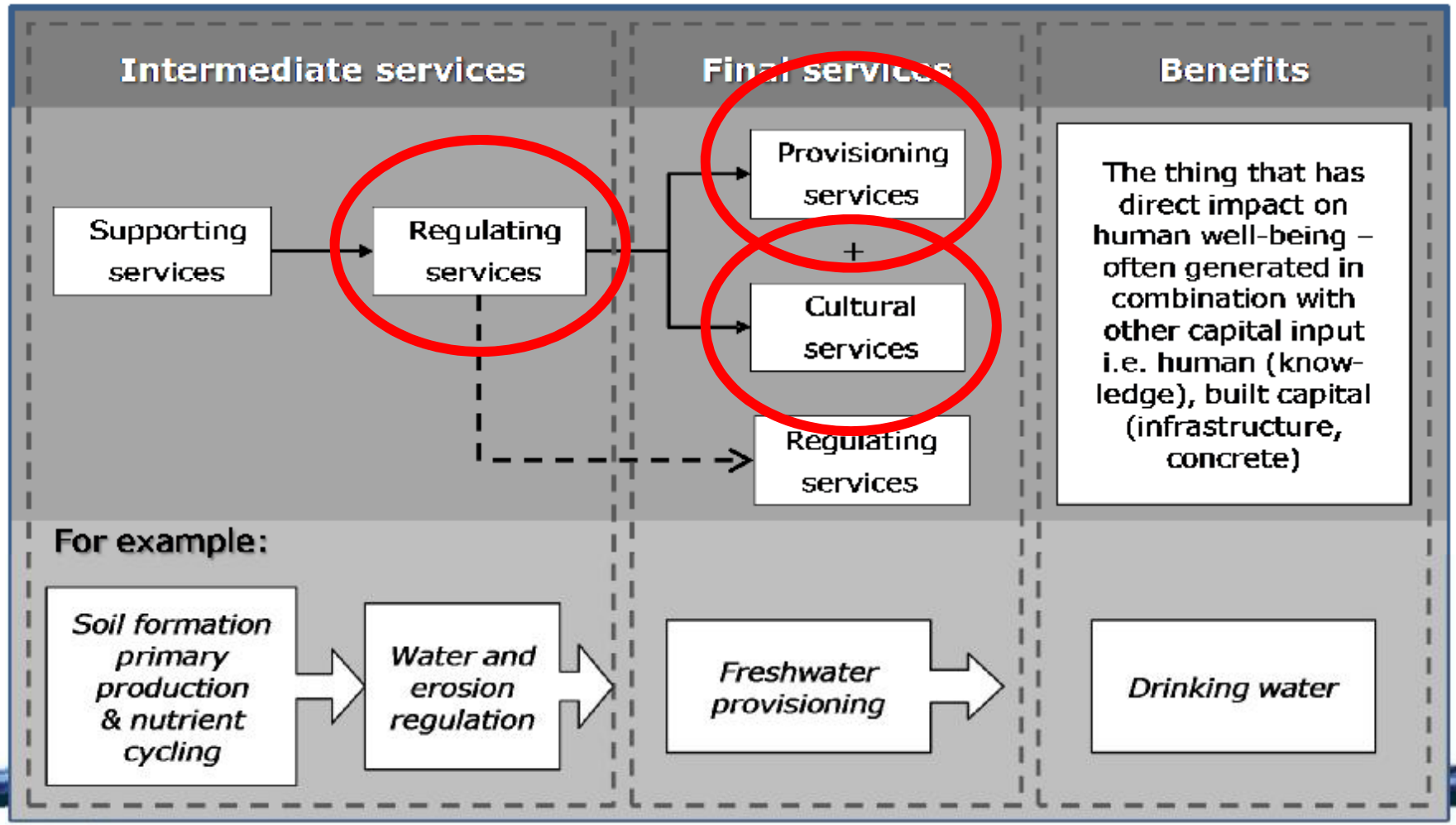
Ecosystem services

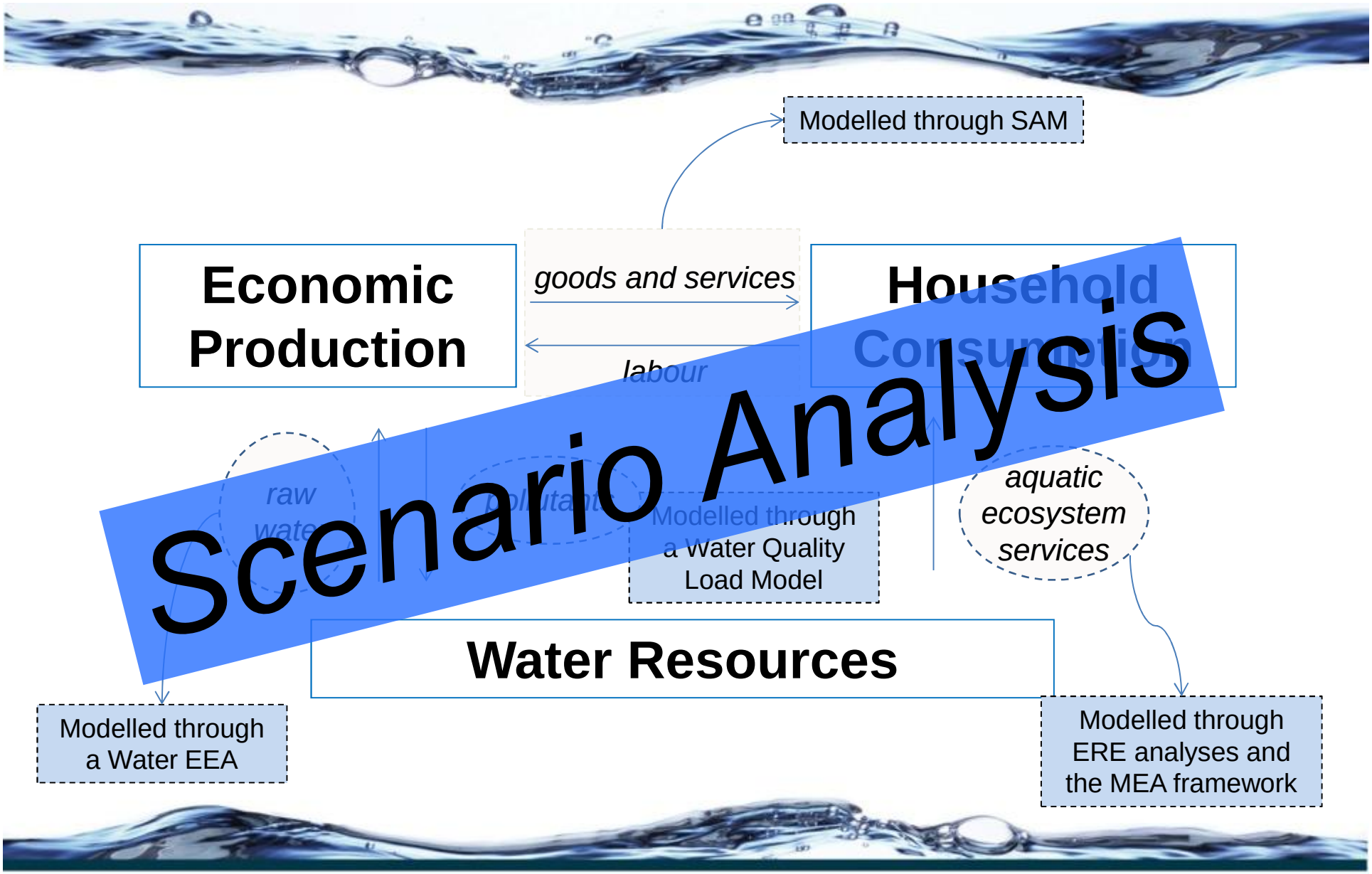


Ecosystem services



Cost of water pollution abatement

- Based on the “Polluter pays” principle
- Internalises water pollution into the production economy
- Links to Resource Quality Objectives (RQOs)



Scenario Analysis

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Conduct scenario analyses - 1

- Specify scenario implications
- Adjust models through:
  - Changes in water availability
  - Changes in aquatic ecosystem services
  - Changes in water quality
  - Changes in economic production

Conduct scenario analyses - 2

- SAMs and Water Hybrid Account
  - For the WMA
- Ecosystem services
  - ES = f(affected water resource)
- Cost of water treatment
  - By EWR node

Way Forward

Step 1: Delineate the units of analysis and describe the status quo of the water resource or water resources;

Step 2: Link the socio-economic and ecological value and condition of the water resource or water resources;

Step 3: Quantify the ecological water requirements and changes in non-water quality ecosystem goods, services and attributes;

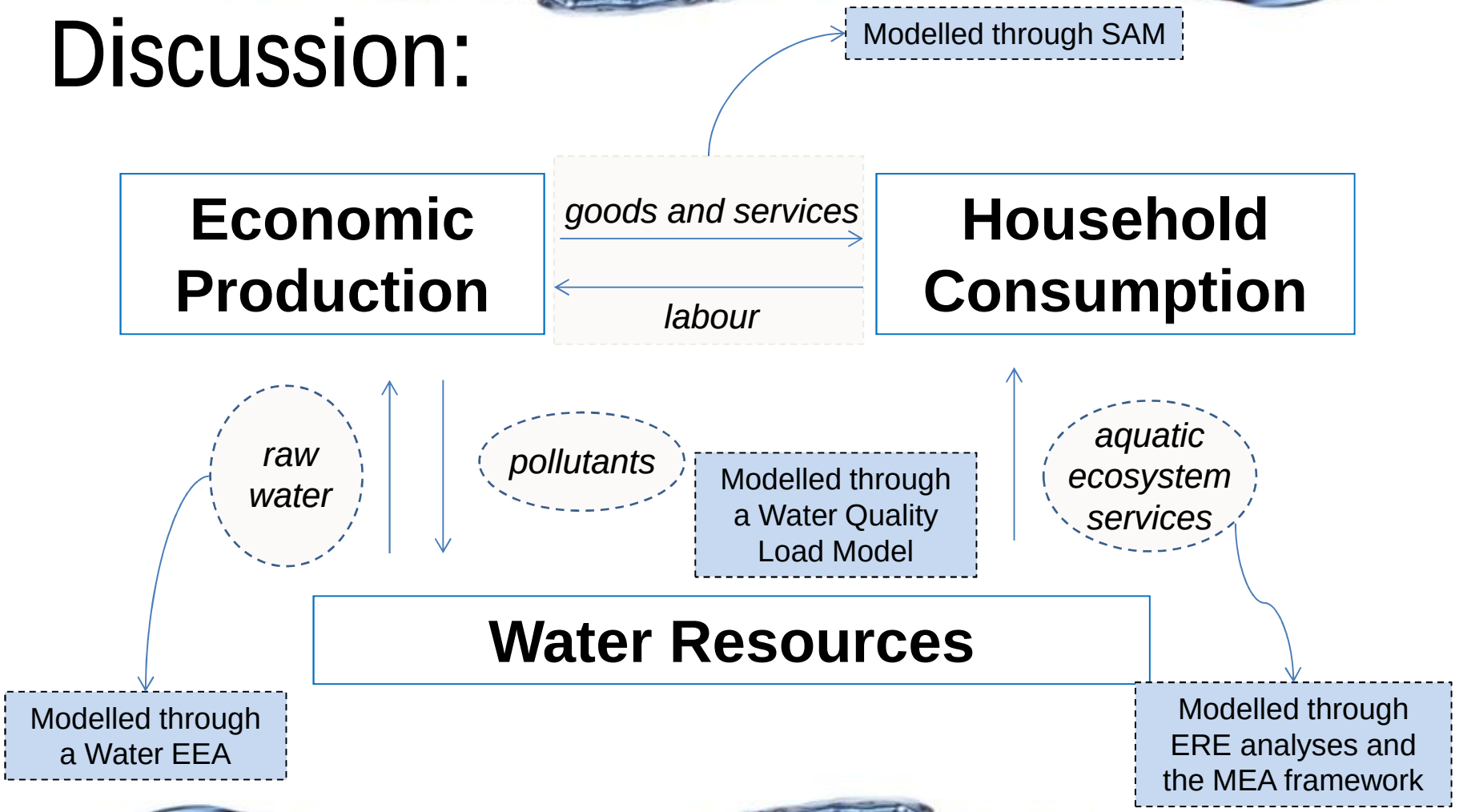
Step 4: Determine an ecologically sustainable base configuration scenario;

Step 5: Evaluate scenarios within the integrated water resource management process;

Step 6: Evaluate the scenarios with stakeholders; and

Step 7: Gazette and implement the class configuration

Discussion:


Modelled through SAM
Economic Production
goods and services
labour
Household Consumption
raw water
pollutants
Modelled through a Water Quality Load Model
aquatic ecosystem services
Water Resources
Modelled through a Water EEA
Modelled through ERE analyses and the MEA framework

FIN