DETERMINATION OF WATER RESOURCE CLASSES, RESERVE AND RESOURCE QUALITY OBJECTIVES IN THE KEISKAMMA AND FISH TO TSITSIKAMMA CATCHMENTS WITHIN THE MZIMVUBU-TSITSIKAMMA WATER MANAGEMENT AREA (WP11354)

Project Steering Committee Meeting (3)

Presented by: GroundTruth and Collaborators
Designation: Study team
Directorate: PSC Panel

Date: 21 January 2025

WATER IS LIFE - SANITATION IS DIGNITY

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

2030 NDP

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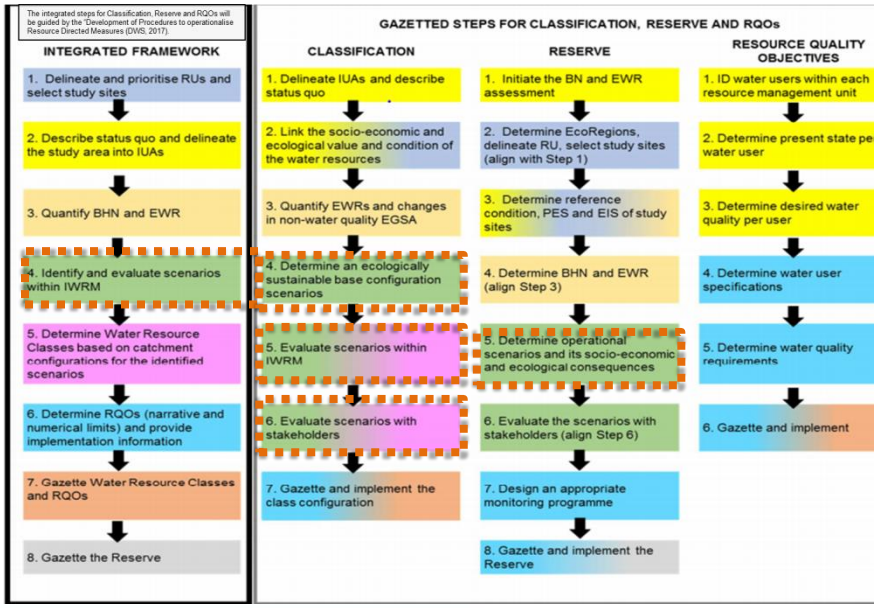
PROJECT POSITION



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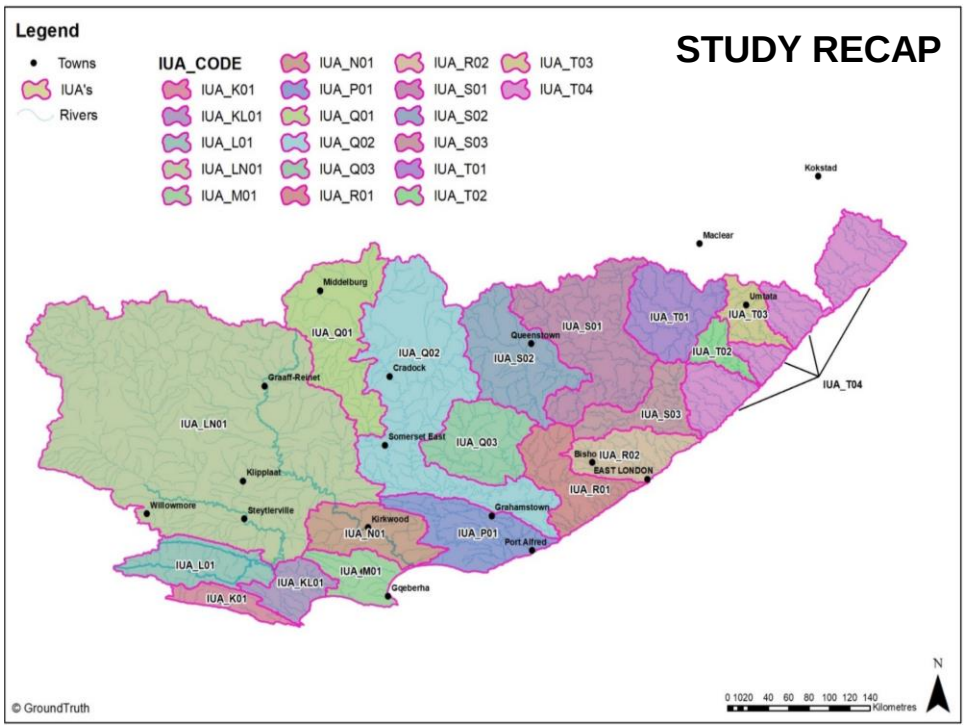
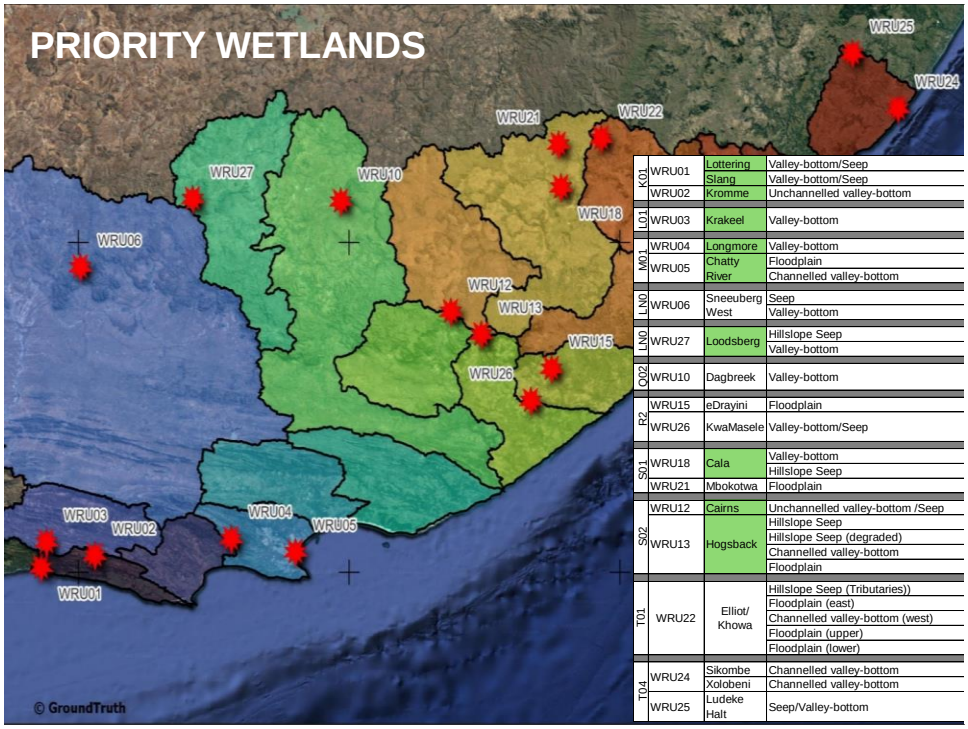
STUDY PROGRESS SINCE PSC2

- PSC2 (June 2023):
  - Progress overview of the various priority water resources (excluding estuaries)
- Progress to date:
  - Wetland and groundwater components completed (next RQOs)
  - Estuarine and river eco-categorisation and EWR quantifications completed
  - Basic Human Needs and socio-economic reporting completed
  - Focus on todays meeting 1: identified operational and flow scenarios per Integrated Units of Analysis
  - Focus on todays meeting 2: associated ecological and socio-economic consequences of the scenarios

STUDY RECAP



PRIORITY WETLANDS



K01	WRU01	Lottering	Valley-bottom/Seep
		Slang	Valley-bottom/Seep
	WRU02	Kromme	Unchannelled valley-bottom
L01	WRU03	Krakeel	Valley-bottom
M01	WRU04	Longmore	Valley-bottom
	WRU05	Chatty River	Floodplain
			Channelled valley-bottom
LN01	WRU06	Sneeuberg West	Seep
			Valley-bottom
LN01	WRU27	Loodsberg	Hillslope Seep
			Valley-bottom
O02	WRU10	Dagbreek	Valley-bottom
R2	WRU15	eDrayini	Floodplain
	WRU26	KwaMasele	Valley-bottom/Seep
S01	WRU18	Cala	Valley-bottom
			Hillslope Seep
	WRU21	Mbokotwa	Floodplain
S02	WRU12	Cairns	Unchannelled valley-bottom /Seep
	WRU13	Hogsback	Hillslope Seep
			Hillslope Seep (degraded)
			Channelled valley-bottom
			Floodplain
T01	WRU22	Elliot/ Khowa	Hillslope Seep (Tributaries))
			Floodplain (east)
			Channelled valley-bottom (west)
			Floodplain (upper)
			Floodplain (lower)
T04	WRU24	Sikombe	Channelled valley-bottom
		Xolobeni	Channelled valley-bottom
	WRU25	Ludeke Halt	Seep/Valley-bottom

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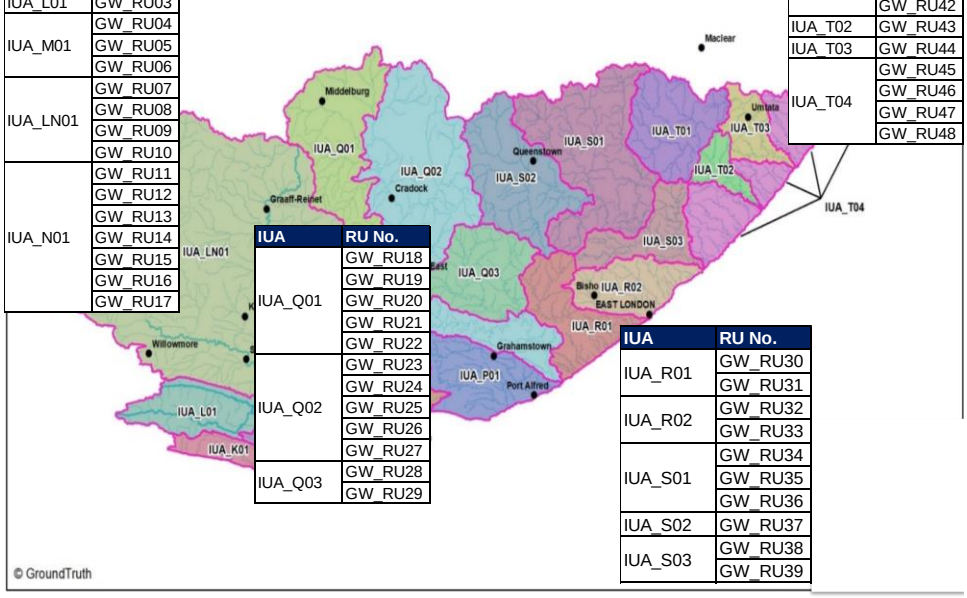
PRIORITY GROUNDWATER

IUA	RU No.
IUA_K01	GW_RU01
IUA_KL01	GW_RU02
IUA_L01	GW_RU03
IUA_M01	GW_RU04
	GW_RU05
	GW_RU06
IUA_LN01	GW_RU07
	GW_RU08
	GW_RU09
	GW_RU10
IUA_N01	GW_RU11
	GW_RU12
	GW_RU13
	GW_RU14
	GW_RU15
	GW_RU16
	GW_RU17



IUA	RU No.
IUA_Q01	GW_RU18
	GW_RU19
	GW_RU20
	GW_RU21
	GW_RU22
IUA_Q02	GW_RU23
	GW_RU24
	GW_RU25
	GW_RU26
	GW_RU27
IUA_Q03	GW_RU28
	GW_RU29

IUA	RU No.
IUA_T01	GW_RU40
	GW_RU41
	GW_RU42
IUA_T02	GW_RU43
IUA_T03	GW_RU44
IUA_T04	GW_RU45
	GW_RU46
	GW_RU47
	GW_RU48

IUA	RU No.
IUA_R01	GW_RU30
	GW_RU31
IUA_R02	GW_RU32
	GW_RU33
IUA_S01	GW_RU34
	GW_RU35
	GW_RU36
IUA_S02	GW_RU37
IUA_S03	GW_RU38
	GW_RU39

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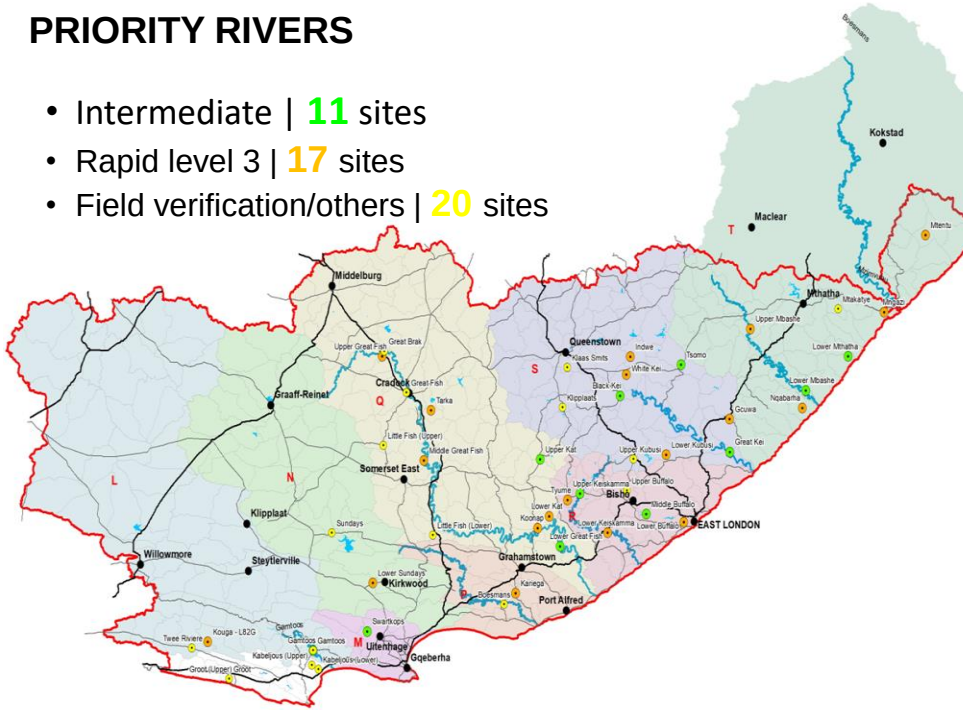
PRIORITY RIVERS

- Intermediate | **11** sites
- Rapid level 3 | **17** sites
- Field verification/others | **20** sites



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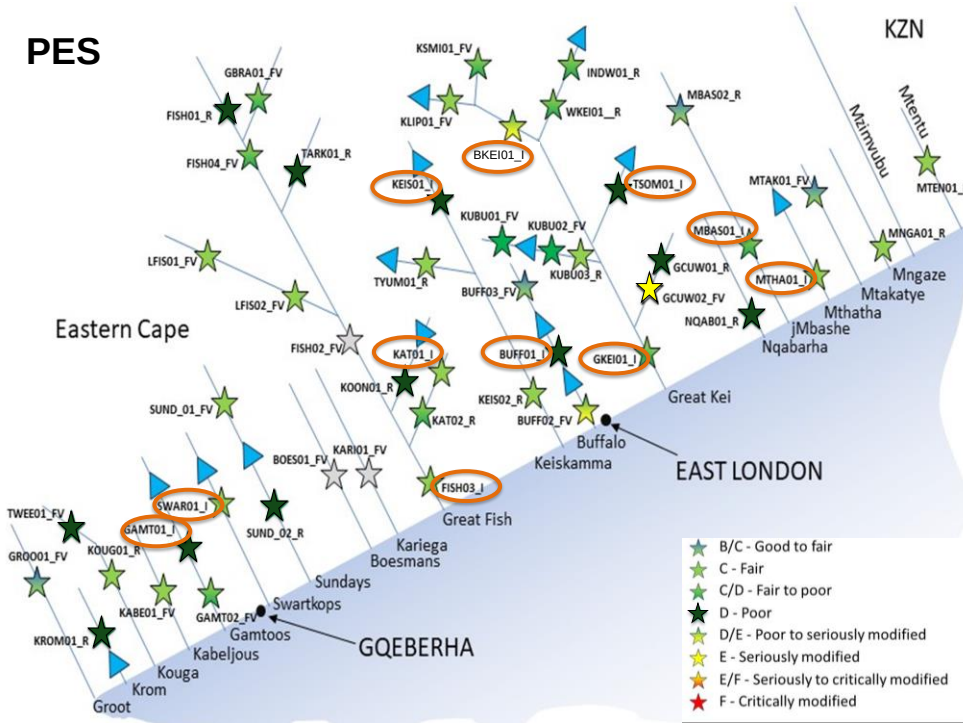
PES



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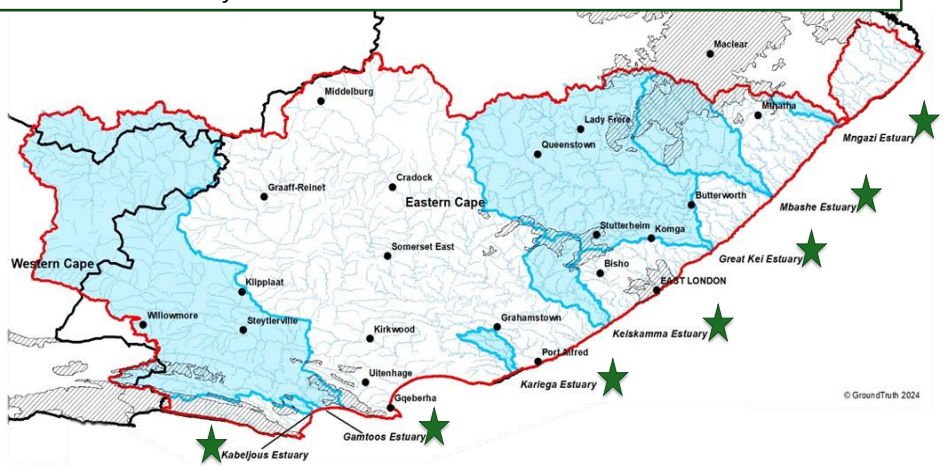
EWR QUANTIFICATION

IUA	EWR site code	River	Quat*	PES	REC	Total EWR as %nMAR for REC	nMAR (10^6m^3)
IUA_T03	MTHA01_I	Mthatha (Lower)	T20G	C	B/C	37.81	389.2
IUA_T02	MBAS01_I	Mbhashe (Middle)	T13C	C/D	C/D	38.02	673.8
IUA_S02	BKEI01_R	Black Kei	S32K	D/E	D	32.03	187.9
IUA_S03	GKEI01_I	Great Kei	S70A	C/D	C	24.97	897.2
IUA_S01	TSOM01_I	Tsomo	S50G	D	C/D	37.48	196.7
IUA_R02	BUFF01_I	Buffalo (Middle)	R20F	D	D	34.46	83.8
IUA_R01	KEIS01_I	Keiskamma (Upper)	R10E	D	D	34.31	58.8
IUA_Q03	KAT01_I	Kat (Upper)	Q94B	C	B/C	43.53	23.9
IUA_Q02	FISH03_I	Great Fish (Lower)	Q91B	C	C	29.73	331.8
IUA_M01	SWAR01_I	Swartkops	M10C	C	B/C	39.97	27.3
IUA_KL01	GAMT01_I	Gamtoos	L90A	D	D	10.80	427.0

PRIORITY ESTUARIES

- 10 estuaries focused on, with 7 estuaries assessed in detail - address gaps
- Influenced by
  - Water resources pressure (current or future)
  - Ecological importance
  - Requests from other sectors of government
  - Available study resources



PRIORITY ESTUARIES

Key Ecosystem Services

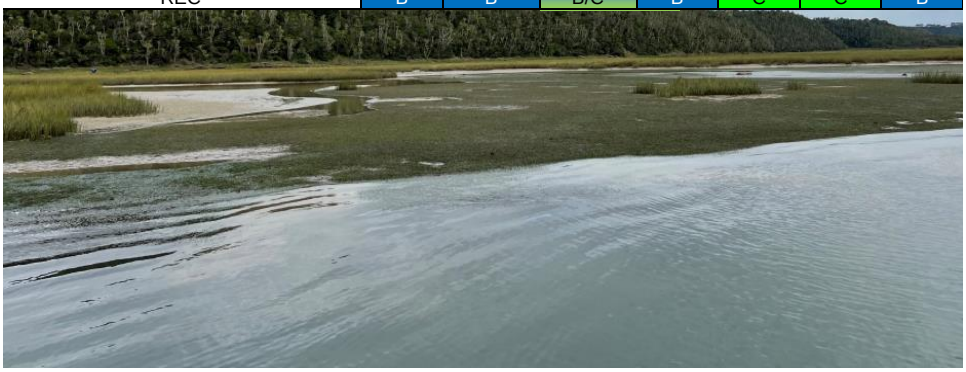
	Mngazi	Mbashe	Great Kei	Keiskamma	Kariega	Gamtoos	Kabeljous
Nursery function	Medium	High	High	High	High	High	Medium
Blue Carbon sequestration	Low	High	High	High	High	High	High

Protected /desired Area Status

	Mngazi	Mbashe	Great Kei	Keiskamma	Kariega	Gamtoos	Kabeljous
Marine Protected Area / Protected Area		Dwesa-Cwebe MPA					
Desired PA/MPA needed to make Conservation targets			-NBA 2011 -GBF 2030	-NBA 2011 -GBF 2030	-NBA 2011 -GBF 2030	-NBA 2011 -GBF 2030	

PRIORITY ESTUARIES – PES & REC

	Mngazi	Mbashe	Great Kei	Keiskamma	Kariega	Gamtoos	Kabeljous
PES	B	B/C	C	C	C	D	B
Estuarine Importance Ratings	Low to average	Highly Important	Highly Important	Highly Important	Highly Important	Highly Important	Important
REC	B	B	B/C	B	C	C	B



PRIORITY ESTUARIES – FINAL EWR's

Estuary System	Quaternary catchment	REC	Total EWR as %nMAR for REC	nMAR ($10^6 m^3$)
Mbashe	T13E	B	108.5	786.9
Xora	T80D	B	77.3 + 5%	52.4
Msikaba	T60G	A	93.8	212.4
Mngazi	T70B	B	95	87.3
Great Kei	S70F	B/C	74.1	1040.7
Keiskamma	R10M	B	76.8	128.7
Nahoon	R30F	C	62.8 + 5%	32.5
Qinera	R30F	B	98.3	8.4
Great Fish	Q93D	B/C	90.3	496.3
Sundays	N40F	B	95	263.1
Swartskops	M10D	C	123.9	56.9
Kariega	P30C	C	60	21.9
Bushmans	P20A	B	75.8 + 3%	43.1
Kowie	P40C	B/C	89.1	31.4
Gamtoos	L90C	C	51.8	404.2
Kabeljous	K90G	B	89.3	5.3
Kromme	K90E	C	51	72.2
Tsitsikamma	K80B	B	66.9 + 5%	19.9

REMAINING ESTUARIES

- In addition, assessed all other 155 estuaries
  - Re-assessed pressures
    - Flow modification
    - Pollution
    - Habitat loss
    - Fishing effort
    - Invasive alien plants and fish
    - Artificial breaching
  - Updated PES - large number still in a natural to near-natural state
    - ~51 in a PES A to A/B
    - ~66 in a PES B
    - ~10 in a PES B/C
    - ~15 systems in a PES C Category
    - ~4 are degraded to a PES C/D and D Category each

Also assessed extent of protection required for all estuaries, importance scores and overall REC for the estuaries

SNAPSHOT OF RESULTS

#	Estuary	In Marine /Protected Area	Priority set for national and/or Regional	Recommended extent of protection	Recommended extent of undeveloped margin	Provisional estimate of Recommended Ecological Category	2030 GBF 30%	Include Freshwater Plume at mouth	Possible Stewardship/OECM
50	Goda	●	CAPE	Full	0.75	B			
51	Hlozi	●				B			
52	Hickman's	●				B			
53	Buffalo					C			
54	Blind					C			
55	Hlaze (iHlanze)	●				C			
56	Nahoon	●				B*			
57	Qinira (Quinirha)	●				A			
58	Gqunube	●	SA	Partial	0.5	A			
59	Kwelera (Kwelerha)	●	SA	Partial	0.5	A			

##	Name	Estuary Type	PES	REC	Natural MAR (m^3x10^6)	Present MAR (m^3x10^6)	% Similarity MAR	Base flows stress	Loss of resetting floods	Potential for water resource development from natural
50	Goda	Large Temporarily Closed	B	A/B	6.2	5.8	93.2	●		
51	Hlozi	Small Temporarily Closed	B	B	1.7	1.6	93.2			
52	Hickman's	Small Temporarily Closed	C	C	1.4	1.3	93.2			
53	Buffalo	Predominantly Open	D/E	D	96.0	18.7	19.5	●		95-99%
54	Blind	Small Temporarily Closed	D	D	0.7	1.1	58.0	●		
55	Hlaze (iHlanze)	Small Temporarily Closed	D	D	0.3	0.8	39.5	●		
56	Nahoon*	Predominantly Open	C/D	C	32.5	20.4	62.8	●	●	62.8%% + 5%⬆
57	Qinira (Quinirha)	Large Temporarily Closed	B	B	8.4	8.3	98.3			98.3%
58	Gqunube	Predominantly Open	B/C	B	34.1	32.1	94.1			
59	Kwelera (Kwelerha)	Predominantly Open	B	A/B	34.8	32.8	94.2			
60	Bulura (Bulurha)	Large Temporarily Closed	B	B	3.7	3.5	94.3			
61	Cunge	Small Temporarily Closed	A/B	A/B	0.3	0.3	97.2			

No.	NAME	Reference MAR (m^3x10^6)	Present MAR (m^3x10^6)	% Similarity MAR	Pressure: Flow modification	Pressure: Pollution	Pressure: Habitat loss	Pressure: Fishing Effort 2024 (NEFF)	Pressure: Invasive alien plants	Pressure: Alien Fish	Artificial Breaching
50	Goda	6.19	5.76	93	L	M	L	L		N	
51	Hlozi	1.75	1.63	93	L	M	L	L		N	
52	Hickman's	1.42	1.33	93	M	VH	M	L		N	
53	Buffalo	96.03	18.70	19	VH	VH	M	VH		VH	
54	Blind	0.65	1.12	58	H	VH	M	L		N	
55	Hlaze (iHlanze)	0.32	0.80	39	VH	VH	M	L		N	
56	Nahoon	32.481	20.41	63	H	H	M	VH	H	H	
57	Qinira (Quinirha)	8.44	8.30	98	L	L	L	H		N	L
58	Gqunube	34.07	32.05	94	L	M	L	H		H	

No.	Estuary	Hydrology	Hydrodynamics	Water Quality: Salinity	Water Quality: General	Water Quality	Physical habitat Category	Habitat Score	Microalgae	Macrophytes	Invertebrates	Fish	Birds	Biological Category	PES 2024
50	Goda	B	B	B	C	B	B	B	B	B	B	B	B	B	B
51	Hlozi	B	B	B	C	B	B	B	B	B	B	B	B	B	B
52	Hickman's	C	C	B	E	D	B	C	D	C	C	C	B	C	C
53	Buffalo	F	C	D	E	E	E	E	E	C	E	E	E	D	D/E
54	Blind	D	C	C	F	E	D	D	D	C	D	D	D	D	D
55	Hlaze (iHlanze)	E	D	D	F	E	B	D	E	C	D	D	C	D	D
56	Nahoon	C	A	D	D	D	B	B	D	C	D	D	D	D	C/D
57	Qinira (Quinirha)	A	B	B	C	C	C	B	B	B	C	D	C	C	B

Report and results available online: https://www.dws.gov.za/RDM/WRCS/kft.aspx

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WATER RESOURCE SCENARIOS

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SCENARIOs: WHAT ARE THEY?

- Scenarios, in context of water resource management and planning, are plausible definitions (settings) of all the factors (variables) that influence the water balance and water quality in a catchment and the system as a whole;
- Each scenario represents an alternative future condition;
- Generally reflects a change to the present condition;
- Such analysis enables a comparison of different scenarios, helping to choose the preferred one;
- Scenarios come in the form of proposed:
  - Dams
  - Weirs
  - Irrigations
  - Hydropower
  - Transfer schemes
  - Pipelines between catchments etc.

Different levels of water use and protection are evaluated with the aim to find a balanced scenario.

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OPERATIONAL SCENARIOS

Scenario	Scenario descriptions	
Scenario 1 (Sc1)	Present Day Demands	Sc1a (without EWR) – "modelling flows in rivers/ estuaries and supply to users without EWR"
		Sc1b (with EWR - rivers) – "the EWR for REC for rivers will be included into the models and prioritised to ensure the flows are provided to meet the ecological needs – will need to assess whether meets the socio-economic needs/potential trade-offs?"

Scenario	Scenario descriptions	
Scenario 2 (Sc2)	Medium Term (2030)	Sc2a (without EWR)
		Sc2b (with EWR - rivers)

Scenario	Scenario descriptions	
Scenario 3 (Sc3)	Long Term (2050)	Sc3a (without EWR)
		Sc3.1a (intervention alternative scenario without EWR)
		Sc3b (with EWR - rivers)
		Sc3.1b (intervention alternative scenario with EWR for rivers)

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OPERATIONAL SCENARIOS

Scenario	Scenario descriptions	
Scenario 4	Water quality (considered and predicted)	Only selected IUAs were assessed where water quality was identified to be of a concern.

Scenario	Scenario descriptions	
Scenario 5 *Still under discussion!	Climate Change (considered and predicted)	Models were run stochastically;
		Selected a drier time series (that correlated with the anticipated changes) and used that as the historical alternative sequence;
		Algoa reduced availability although were not reflected within the models;
		Amatola – projections were not sufficiently clear whether there was an increase/decrease, thus no change in the water balance was made;
		The range of flows were assessed;
		Only one climate change scenario was assessed and for specific IUAs where most impact expected

HYDROLOGICAL MODELLING

- **Background and Setup**
  - Latest hydrological data available is WRSM2000 models from Water Resources of South Africa, 2012 Study (WR2012) – most of study area except Algoa and Amathole systems
  - Hydrology from 1920 to 2009 (hydrological years)
  - Updated with any newer demand information such as:
    - All Towns Reconciliation Strategies and AOAs for stand-alone dams
    - Information received from the region (water use and dam outlet capacities)
  - Converted to Water Resource Yield Models (WRYM) – to allow revised operations for EWRs.
  - Models were created per river system and joined where appropriate (i.e. physical connections such as transfers)
  - Models for Algoa (Nelson Mandela Bay Metropolitan Municipality) and Amathole (Buffalo City Metropolitan Municipality) – used latest focused studies information and models.

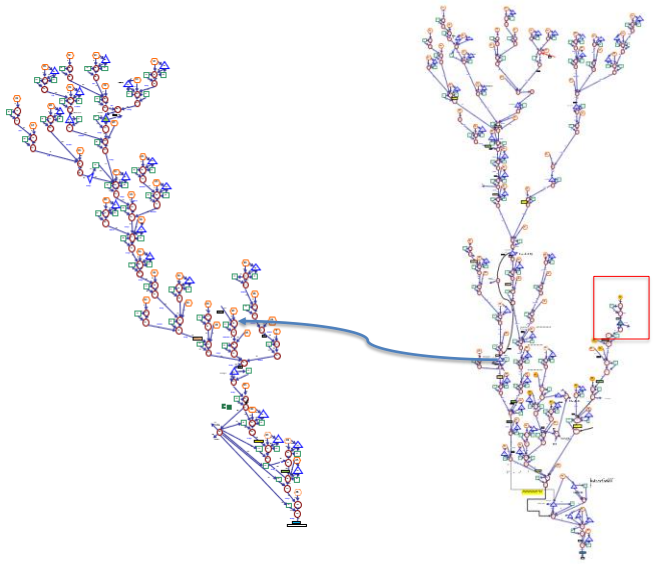
HYDROLOGICAL MODELLING

- **Background and Setup (continued)**
  - Algoa model - combination of the WR2012's WRSM2000 models (Groot and Coastal Catchments), new models developed as part of the current (WAAS) Water Availability Assessment Study, and hydrology extension by the Reconciliation Strategy (Swartkops).
  - Amathole model created as part of the Buffalo City Reconciliation Strategy (which was aligned with the annual operation Analysis (AOA) – WRPM model, but extended to the coast / estuaries).

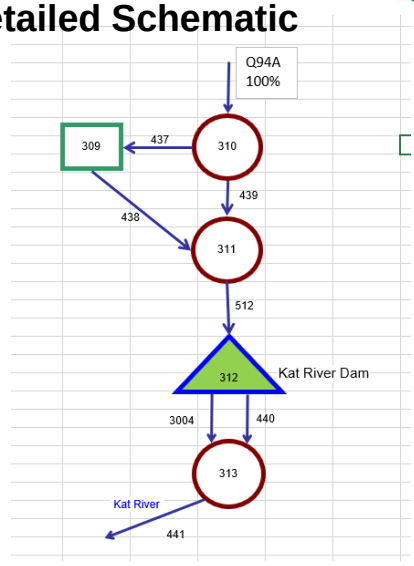
HYDROLOGICAL MODELLING

- **The final list of models includes:**
  - Algoa (WRYM)
  - Amathole (WRYM)
  - Great Kei with Mbashe (WRYM)
  - Keiskamma (WRYM)
  - Fish Sundays (WRYM)
  - Mthatha (WRYM)
  - Msikaba (WRYM)
  - Mngazi (WRYM)
  - Bushmans, Kariega, Kowie, East Kleinemonde (WRYM)
- **System schematics**
  - Models use a combination of nodes, links to represent a river system
  - Graphical expression
  - These graphically representations can grow to be large and complex

Example: Fish Sundays Schematic

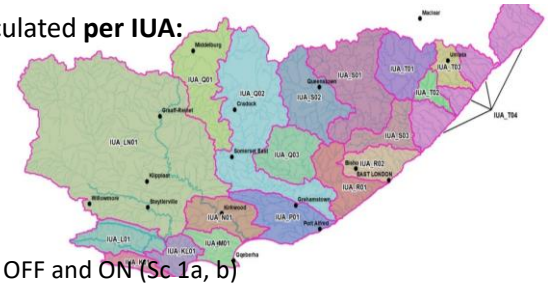


Example: Detailed Schematic



WATER RESOURCE MODELLING

- Considerations and what is calculated **per IUA:**
  - Domestic requirements
  - Irrigation requirements
  - Hydropower requirements
  - Water transfers
  - Forestry requirements
- Analysis procedure
  - Run each scenario with EWRs OFF and ON (Sc 1a, b)
  - Compare the Annual Requirements against the Annual Supply
  - Count the number of failures (Shortfall > 0.002 million m^3/year)
  - Calculate the Monthly Reliability of Supply (RoS)
  - Evaluate the impact of implementing EWRs by comparing the RoS with EWRs OFF and ON
  - Status of user defined according to RoS
  - Based on the following general categories:



Status	Domestic	EWR	IRR	Hydropower
Ideal	>98%	>98%	>95%	>95%
Good	95%-98%	95%-98%	90%-95%	90%-95%
Ok	90%-95%	90%-95%	75%-90%	75%-90%
Poor	75%-90%	75%-90%	50%-75%	50%-75%
Bad	<75%	<75%	<50%	<50%

ECOLOGICAL SUSTAINABLE BASE CONFIGURATION SCENARIO

- Forms part of **step 4** of the Classification process and aligns with Step 4 of the integrated framework (DWS, 2017)
- An ESBC scenario is designed to assess the water availability of a system when applying the minimum ecological protection necessary for sustainable use of a catchment's water resources
- Considers ecological, water quality, and quantity needs
- Thus, its purpose is to:
  - Describe the state of water resources per IUA at each of the identified EWR sites throughout the study area
  - Establish the ESBC for each IUA based on REC for both the rivers and estuaries
  - Model the EBCS scenario and interpret the results

ECOLOGICAL SUSTAINABLE BASE CONFIGURATION SCENARIOS

- ESBC scenarios considered:
  - Scenario 1a: Present-day water flows and supply without Ecological Water Requirements (EWR) (EWR OFF); and
  - Scenario 1b: Present-day water flows and supply with EWR for rivers and estuaries (EWR ON).
- The ESBC results indicated IUAs where there are already negative ecological or socio-economic consequences that were further evaluated with the future scenarios.

ECOLOGICAL AND SOCIO-ECONOMIC CONSEQUENCES

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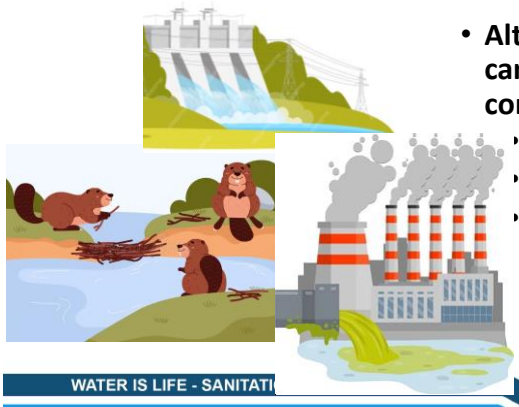
DETERMINING ECOLOGICAL CONSEQUENCES OF SCENARIOS?

- Need to answer the 'what if' questions;

CONSEQUENCE: COMES AFTER…. OR A RESULT OR EFFECT OF SOMETHING…



- **Altering the natural flow of a river, can have severe ecological consequences**
  - Disrupt habitats
  - Decline water quality
  - Affect overall biodiversity

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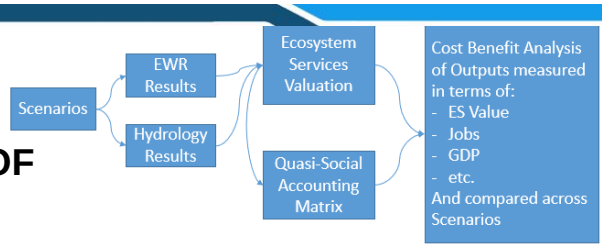
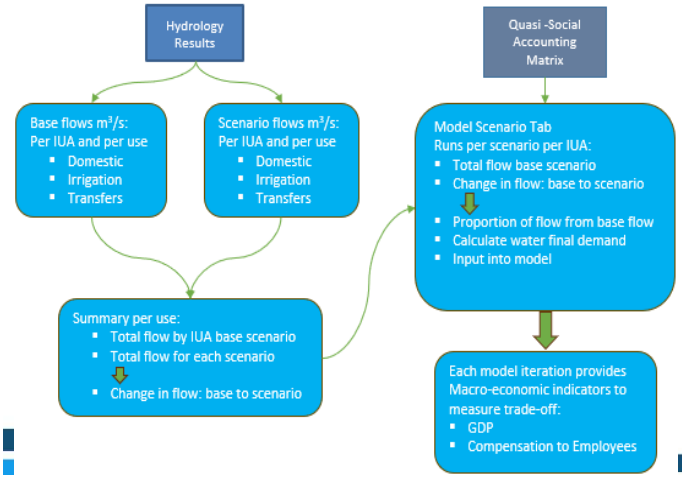
DETERMINING ECOLOGICAL CONSEQUENCES OF SCENARIOS

- Express in terms of change in Ecological Category & degree to which the REC is met
- Used the Eco-categorisation models to predict changes in the geomorphic and riparian vegetation biophysical components for each scenario
- Assessed the biotic consequences using the Fish, Invertebrate, Flow, Habitat Assessment Index (FIFHA) where applicable
- Estuaries consequences assessed per scenario
- Main purpose to see whether possible (and socio-economic implications) of improving the river and/or estuarine systems

DETERMINING SOCIO-ECONOMIC CONSEQUENCES OF SCENARIOS





Set up integrated economic model

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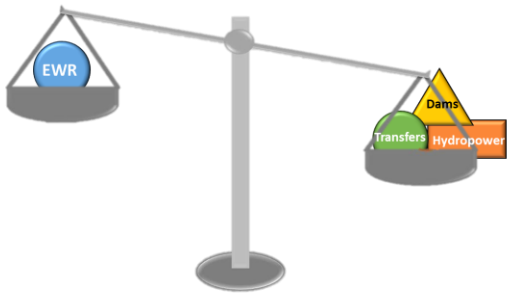
SCENARIO EVALUATION OUTCOMES



Trade-off evaluation

- The process requires a wide range of trade-offs to be evaluated at a number of scales;
- This ensures bringing the system more into balance and to determine the Water Resource Classes per IUA in the next phase; and
- Final outcome of the process is a set of desired characteristics for use and ecological condition for each of the water resources.

- Recommend classes for IUAs for the Minister's consideration.

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TRADE-OFF EVALUATION

- Key considerations:
  - Flow reduction and changes to seasonality are key concerns;
  - Modified flows prevent freshets and floods, harming habitats;
  - Water quality a major concern for most IUAs;
  - Water resources for a number of IUAs are overused;
  - Ecological needs can't be met due to over-allocation for transfers and local demands;
  - Significant trade-offs will be necessary for sustainable water management; some IUAs have mitigation options;
  - Priority should be given to local domestic supply over future transfers;
  - Maintaining most of the estuary requirements (flow and ecological categories);
  - Immediate, medium- and long-term interventions are needed; and
  - This classification is the best approach for ecological sustainability with minimal economic impact.

EXPECTED OUTCOMES

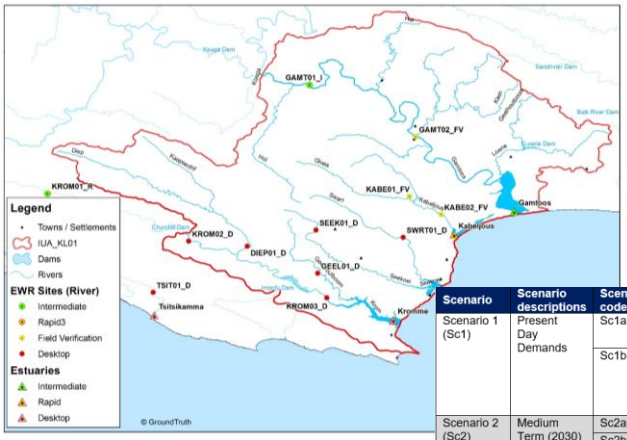
- **Stakeholders generally want the following:**
  - Abundant clean water for consumption purposes
  - Abundant clean water for economic purposes – this to secure business activities and jobs
  - A clean natural environment for various purposes of recreation
  - To pay low or zero water prices
- However, as we move into a future of **increasing water scarcity**, it is **not possible to provide all of** the above, all of the time for all people
- The Scenarios will give us options on how we can **balance the above expectations**

SCENARIO AND CONSEQUENCE RESULTS

- Purpose of this PSC meeting – selected 2 IUAs to present in detail
- For the rest, please refer to the report that was circulated for review to all PSC members in November and December 2024
- Alternatively: https://www.dws.gov.za/RDM/WRCS/kft.aspx

10. IUA_KL01: Gamtoos

10. IUA_KL01: Gamtoos



Kromme from Kromme Dam to estuary and Gamtoos River
Covers Kromme and Gamtoos Rivers
Linked to the Algoa system

GAMT01_I: PES: D; REC D

Gamtoos Estuary: PES: D; REC C

Scenario	Scenario descriptions	Scenario code	Description
Scenario 1 (Sc1)	Present Day Demands	Sc1a	Sc1a (without EWR) – "modelling flows in rivers/ estuaries and supply to users without EWR"
		Sc1b	Sc1b (with EWR - rivers) – "the EWR for REC for rivers will be included into the models and assessed to aim to meet the flows necessary to meet the ecological needs –socio-economic needs/potential trade-offs also to be assessed"
Scenario 2 (Sc2)	Medium Term (2030)	Sc2a	Sc2a (without EWR)
		Sc2b	Sc2b (with EWR - rivers)
Scenario 3 (Sc3)	Long Term (2050)	Sc3a	Sc3a (without EWR) - Desalination
		Sc3b	Sc3b (with EWR - rivers) - Desalination
		Sc3a.1	Sc3a.1 (without EWR) - With Guernakop Dam
		Sc3b.1	Sc3b.1 (with EWR - rivers) - With Guernakop Dam
		Sc3a.2	Sc3a.2 (without EWR) - With raised Kouga Dam
		Sc3b.2	Sc3b.2 (with EWR - rivers) - With raised Kouga Dam
Scenario 4 (Sc4)	Water quality	Sc4	This IUA was selected where water quality was identified to be of a concern. The future water quality status (either deterioration or improvement) is based on Sc1b – the present-day status of the water quality, along with the EWR for the set REC for rivers and/or estuaries.

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WATER RESOURCE MODELLING: CRITICAL USER REQUIREMENTS

Domestic:

- **Kareedouw**
  - 0.26 to 0.3 million m^3/a
- **Coastal Towns**
  - 8.08 million m^3/a
- **Hankey Patensie**
  - 2.01 million m^3/a

IUA_KL01	Scenario 1		Scenario 2	
	EWR OFF	EWR ON	EWR OFF	EWR ON
EWR	31%	89%	33%	89%
IRR	86%	85%	86%	85%
Domestic	99%	98%	100%	99%

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ECOLOGICAL CONSEQUENCE (GAMT01_I)

					Desalination		Guernakop Dam		Raising Kouga Dam Wall	
REC	Sc 1a	Sc 1b	Sc 2a	Sc 2b	Sc 3a	Sc 3b	Sc 3a.1	Sc 3b.1	Sc 3a.2	Sc3b.2
Geomorphology										
D	C	B/C	C	C	C	C	C	C	C	C

● All scenarios meet REC ● Flood/freshet needs met ● Sc1b: Freshets flush fine sediment ●Sc3: Freshets reduced (winter) - slight sedimentation increase

Riparian vegetation

D	D	D	D	D	D	D	D	D	D	D

● All scenarios meet REC ● Without EWR, less riparian inundation occurs
● Knock-on effect on biota

Biota

Fish	Wet	D	D/E	C	D/E	C	D/E	C	D/E	C	D/E	C
	Dry	D	E	C	E	C	E	C	E	C	E	D
Inverts	Wet	D	E	C/D	E	C/D	E	C/D	E	C/D	E	C
	Dry	D	E	C/D	E	C/D	E	C/D	E	C/D	E	D

● All scenarios when EWR is implemented meets REC ● Without EWR, flow/habitats for indicator species are unmet.

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ECOLOGICAL CONSEQUENCE (water quality)

Present	Scenario 4 (Future)
• Seriously modified (diatoms) • Nutrient loading (agricultural runoff, overgrazing) • Nutrient loading (7/8 WWTWs critically failing - Green Drop scores declined (2013-2022). • Sedimentation (vegetation removal cause erosion) • Estuary quality	• Water quality degradation will worsen, impacting ecosystem health • Failing WWTWs drive the decline • Increased waterborne diseases, risks to communities, and biodiversity

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PROPOSED MITIGATION MEASURES (PRELIM)

- Should any scenario be implemented – ensure EWR is implemented (socio-economic implication)
- Implement catchment management to improve basal cover
- Release higher flows to scour fine sediment from pools and coarse sediment habitats.
- Avoid over-abstraction to prevent downstream river drying
- Upgrade, monitor and maintain WWTW infrastructure in upstream towns
- Implement/assess improved agricultural best practices (e.g., avoiding over-fertilisation and improper irrigation)
- Restore riparian vegetation to support river health - habitats

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ECOLOGICAL CONSEQUENCES *Estuary Sensitivity flow scenarios*

GAMTOOS

Scenario	Description	MAR ($X\ 10^6\ m^3$)	% Similarity
Reference	Natural	404.23	100
Present	Present (no River EWR)	194.82	48.2
1	Restoration Scenario (Present with River EWR, irrigation demands 33% decreased on Kouga Dam, all alien invasives have been removed - except for the Groot)*	219.71	54.4
2	Present (with River EWR)	209.19	51.8
3	Mid-term (no River EWR)	199.86	49.4
4	Long-term Desalination (no EWR)	199.59	49.4
5	Long-term Kouga Dam Raised (with River EWR)	198.60	49.1
6	Long-term Kouga Dam Raised (no River EWR)	192.57	47.6
7	Long-term Worst case (Long-term demands, raised Kouga Dam, no EWR, no support from the Fish/ Sundays scheme)*	175.04	43.3
8	Present (with River EWR) with Estuary Management interventions*	209.19	51.8

	PES	1	2	3	4	5	6	7	8
Health Score	54	65	64	54	55	57	53	46	66
PES	D	C	C	D	D	D	D	D	C
REC	C								

● Sc1, 2 improve estuary to Category C, with minimal difference ● Sc3 to 7 show little change or decline to Category D ● Sc8 provides the best ecological outcomes.

● Recommended Sc2 (present with River EWR) coupled with interventions. The flow requirements for the estuary are the same as those described for Scenario 8 (flows similiar to Scenario 2):

● *Increase baseflows, reduce nutrient inputs* ● *Create buffer zones and develop management plans for restoration* ● *Maintain hydrodynamic variability and reduce fishing pressure* ● *Protect riparian vegetation* ● *restore the estuary floodplain*

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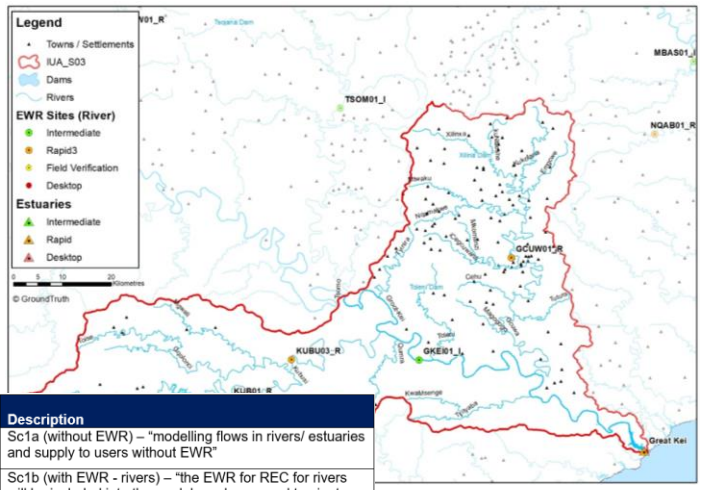
SOCIO-ECONOMIC CONSEQUENCE RESULTS

Karen - SE

21. IUA_S03: Great Kei

21. IUA_S03: Great Kei

Lower Great Kei system, with main tributaries Gcuwa, Kubusi



Scenario	Scenario descriptions	Scenario code	Description
Scenario 1 (Sc1)	Present Day Demands	Sc1a	Sc1a (without EWR) – "modelling flows in rivers/ estuaries and supply to users without EWR"
		Sc1b	Sc1b (with EWR - rivers) – "the EWR for REC for rivers will be included into the models and assessed to aim to meet the flows necessary to meet the ecological needs – socio-economic needs/potential trade-offs also to be assessed"
Scenario 3 (Sc3)	Long Term (2050)	Sc3a	Sc3a (without EWR)
		Sc3b	Sc3b (with EWR - rivers)
Scenario 4 (Sc4)	Water quality	Sc4	This IUA was selected where water quality was identified to be of a concern. The future water quality status (either deterioration or improvement) is based on Sc1b – the present day status of the water quality, along with the EWR for the set REC for rivers and/or estuaries.

GKEI01_I: PES C/D; **REC C**

Great Kei Estuary: PES C; **REC B/C**

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WATER RESOURCE MODELLING: CRITICAL USER REQUIREMENTS

Domestic:

- **Stutterheim**
  - 1.02 to 1.32 million m^3/a
- **Butterworth**
  - 8.5 to 9.08 million m^3/a

Interventions:

- **Stutterheim**
  - Sc2: Groundwater Development of 2 million m^3/a
- **Butterworth**
  - Sc2:
  - Water ReUse of 3.8 million m^3/a
  - Raising of Gcuwa Dam

IUA_S03	Scenario 1		Scenario 2		Scenario 3	
	EWR OFF	EWR ON	EWR OFF	EWR ON	EWR OFF	EWR ON
EWR	49.21%	91.42%	57.20%	91.50%	55.74%	91.46%
Domestic	99.91%	99.91%	99.91%	99.91%	99.91%	99.91%
IRR	83.12%	74.37%	83.48%	74.52%	83.46%	74.41%

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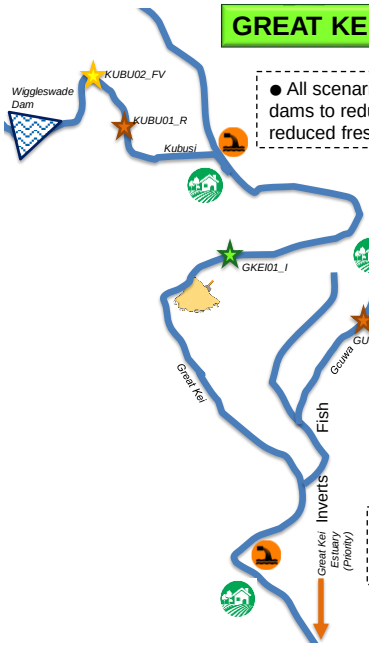
ECOLOGICAL CONSEQUENCES



REC	Sc1a	Sc1b	Sc2a	Sc2b	Sc3a	Sc3b

Geomorphology

C	C	C	C	C	C	C

● All scenarios meet REC ● Dams on tributaries limit flood impact ● No new dams to reduce sediment input ● Flood/freshet requirements met ● ScB's all reduced freshet, increasing sedimentation, habitat deterioration

Riparian vegetation

C	C/D	C/D	C/D	C/D	C/D	C/D

● All scenarios do not fully meet REC ● No dry season inundation of riparian vegetation ● However, scenarios meet required flows, especially in the growing season.

Biota

Fish	Wet	C	B	C	B	C	B
	Dry	C	C	C	C	C	C
Inverts	Wet	B/C	A/B	B/C	A/B	B/C	A/B
	Dry	C	B	C	B	C	B

● All scenarios, whether EWR is implemented or not, meet the REC of a C ● Drying reduces outbreaks (blackfly larvae); floods cleanse habitats

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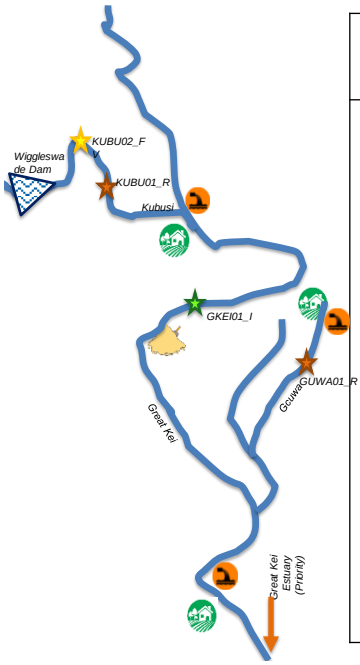
ECOLOGICAL CONSEQUENCE (water quality)



Present	Scenario 4 (Future)
• Moderate to concerning water quality • Simuliidae (blackfly larvae) outbreak • Sedimentations (livestock overgrazing, sand mining, vegetation removal, and agricultural runoff) • 4 WWTWs: 3 are failing (Nqamakwe Prison; Stutteheim, Queenstown (Gcuwa..now Kei) • Estuary quality	• Water quality degradation will worsen, impacting ecosystem health • Failing WWTWs drive the decline • Increased waterborne diseases, risks to communities, and biodiversity

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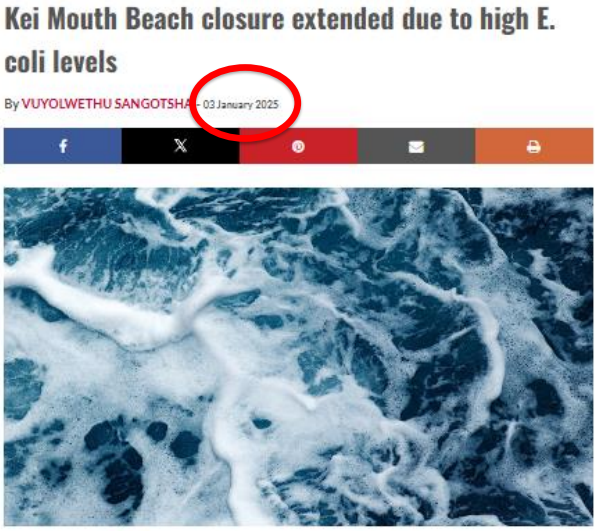
ECOLOGICAL CONSEQUENCE RESULTS cont.

Scenario 4: Water quality



- December 2024 and into January 2025 period
- Alarming high levels of E.coli (staggering 1,000 times higher than the safe limit)
- The acceptable level of E. coli is between 150 to 500 cfu/100ml, while an excellent level is less than 130 cfu/100ml.
- Cumulative sources from upstream i.e.Kei WWTW, Gcuwa River (Butterworth), Komani River (Queenstown)
- Major loss in socio-economics, tourism

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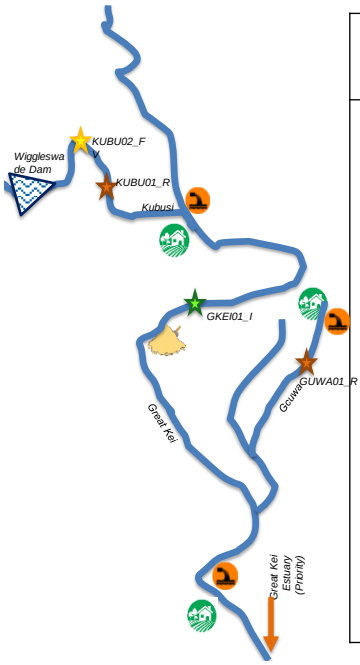
ECOLOGICAL CONSEQUENCE (water quality)



Present	Scenario 4 (Future)
• Moderate to concerning water quality • Simuliidae (blackfly larvae) outbreak • Sedimentations (livestock overgrazing, sand mining, vegetation removal, and agricultural runoff) • 4 WWTWs: 3 are failing (Nqamakwe Prison; Stutteheim, Butterworth (Gcuwa..now Kei) • Estuary quality	• Water quality degradation will worsen, impacting ecosystem health • Failing WWTWs drive the decline • Increased waterborne diseases, risks to communities, and biodiversity

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PROPOSED MITIGATION MEASURES (PRELIM)

- Should any scenario be implemented – ensure EWR is implemented (socio-economic implication)
- Implement catchment management to improve basal cover
- Release higher flows to scour fine sediment from pools and coarse sediment habitats
- **Upgrade, monitor and maintain WWTW infrastructure in upstream towns and at the estuary**
- Restore riparian vegetation to support river health - habitats

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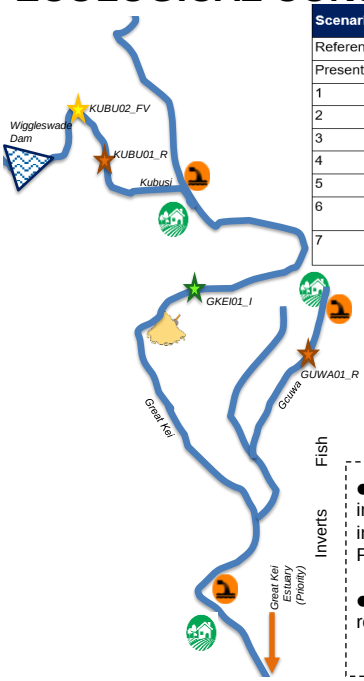
ECOLOGICAL CONSEQUENCES *Estuary Sensitivity flow scenarios*



Scenarios	Description	MAR ($X10^6$ m^3)	% Similarity
Reference	Natural	1040.71	
Present	Present (no river EWR)	741.99	71.3
1	Restoration (Present with river EWR + remove Invasive Aliens)*	771.03	74.1
2	Present (with river EWR)	762.06	73.2
3	Mid-term (no river EWR)	742.24	71.3
4	Long-term (with river EWR)	754.82	72.5
5	Long-term (no river EWR)	734.80	70.6
6	Long-term (no river EWR) and increased baseflow abstraction (3 m^3/s)*	651.51	62.6
7	Restoration (Present with river EWR + remove Invasive Aliens) with additional management interventions at the Estuary*	771.03	74.1

	PES	1	2	3	4	5	6	7
Health Score	**68**	75	74	69	74	68	57	68
PES	**C**	B/C	B/C	C	B/C	C	D	C
REC	**C**							

Fish

Inverts

● Sc1,2,4 improve estuary (B/C), but ecology remains degraded ● Sc7 improves health, meeting key ecosystem services ● Estuary health improves with river EWR release ● Sc3,5 little change ● Sc6 decline to PESD - flow sensitivity

● Recommended Sc1 (present with river EWR release, additional removal of AIP and management interventions

● *EMP, reduce fishing pressure, access management, maintain low flows, nutrients*

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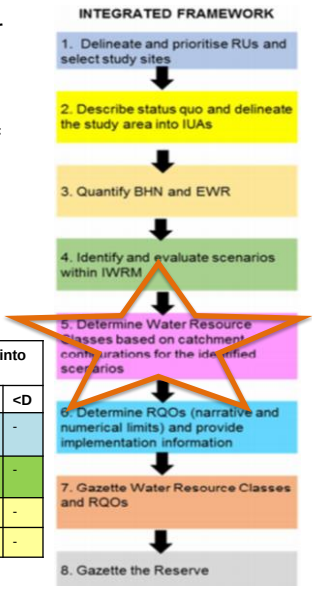
SOCIO-ECONOMIC CONSEQUENCE RESULTS

Karen - SE

WATER RESOURCE CLASSES

- Classification defines the desired state of the water resources by setting Water Resource Classes;
- The WRCS guidelines recommend that the water resource class be determined based on the ECs of the biophysical nodes residing in an IUA (Step 5)
- Each class represents:
  - A different level of protection that is required for the water resource
  - The extent to which the water resource can be used

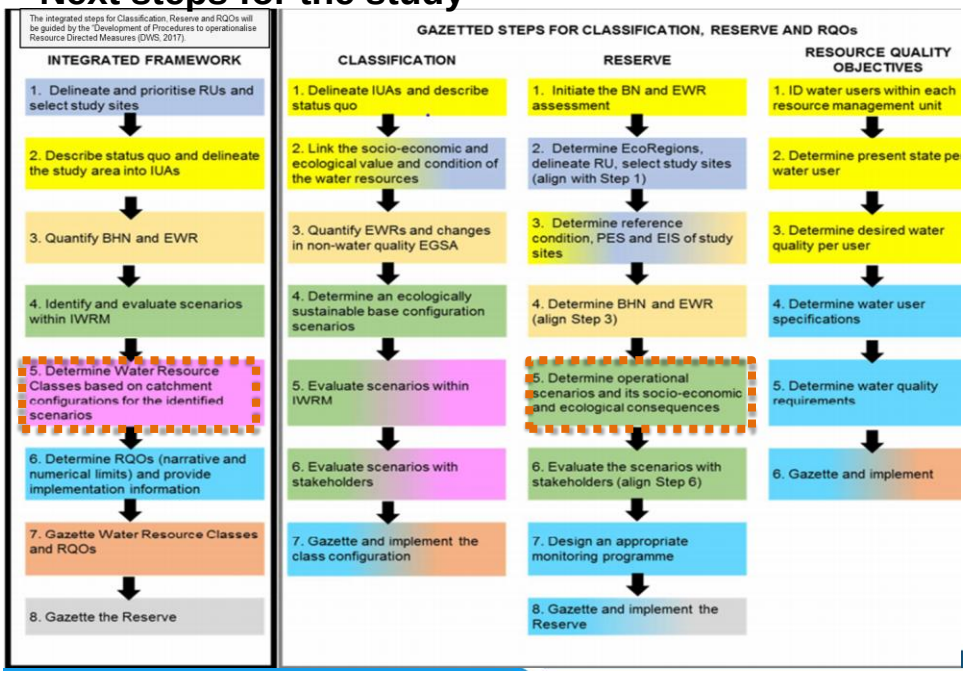
Class and Description		% of nodes in the IUA falling into the indicated EC groups				
		≥A/B	≥B	≥C	≥D	<D
I: Minimally used and configuration of EC of that water resource minimally altered from its pre-development conditions		≥40	≥60	≥80	≥99	-
II: Moderately used and configuration of EC of that water resource moderately altered from its pre-development conditions		-	≥40	≥70	≥95	-
III: Heavily used and configuration of EC of that water resource significantly altered from its pre-development conditions	Either	-	-	≥30	≥80	-
	Or	-	-		100	-



PRELIMINARY WATER RESOURCE CLASSES

Map currently being compiled

Next steps for the study



THANK YOU!

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All study reports can be accessed from the DWS website: https://www.dws.gov.za/RDM/WRCS/kft.aspx

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