water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Determining Water Resources Classes and Associated Resource Quality Objectives in the Breede-Gouritz WMA

Technical Task Group Meeting 1: Presentation of draft Ecological Water Requirements

24 April 2017
Venue: BGWUA offices, Worcester

STEP 1

STEP 1: DELINEATE CATCHMENT & DESCRIBE STATUS QUO

Outcome: IUA & nodes

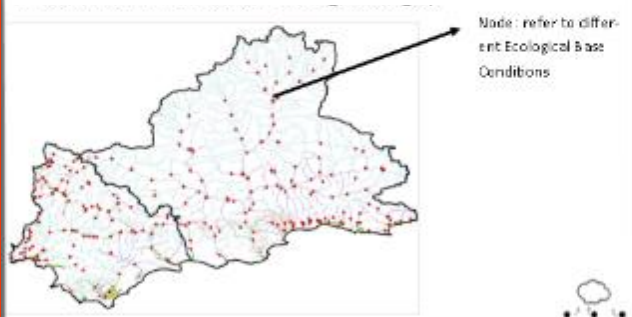
STEP 2: LINK VALUE & CONDITION OF WATER RESOURCE

Outcome: How economic value & social wellbeing influenced by ecosystem char. & use of water

- SOCIAL WELL BEING
- ECOSYSTEM INDEX
- ECONOMIC PROSPERITY

STEP 3: QUANTIFY THE ECOLOGICAL WATER REQUIREMENTS & CHANGES IN EGSAs

Outcome: EWR node table



STEP 4: SET AN ECOLOGICALLY SUSTAINABLE BASE SCENARIO & ESTABLISH STARTER SCENARIOS

Outcome: ESBC scenario

Water Resource Classification Procedure

water & sanitation

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STEP 5: EVALUATE SCENARIOS WITHIN INTEGRATED WATER RESOURCE MANAGEMENT PROCESS

Outcome: Evaluate scenarios

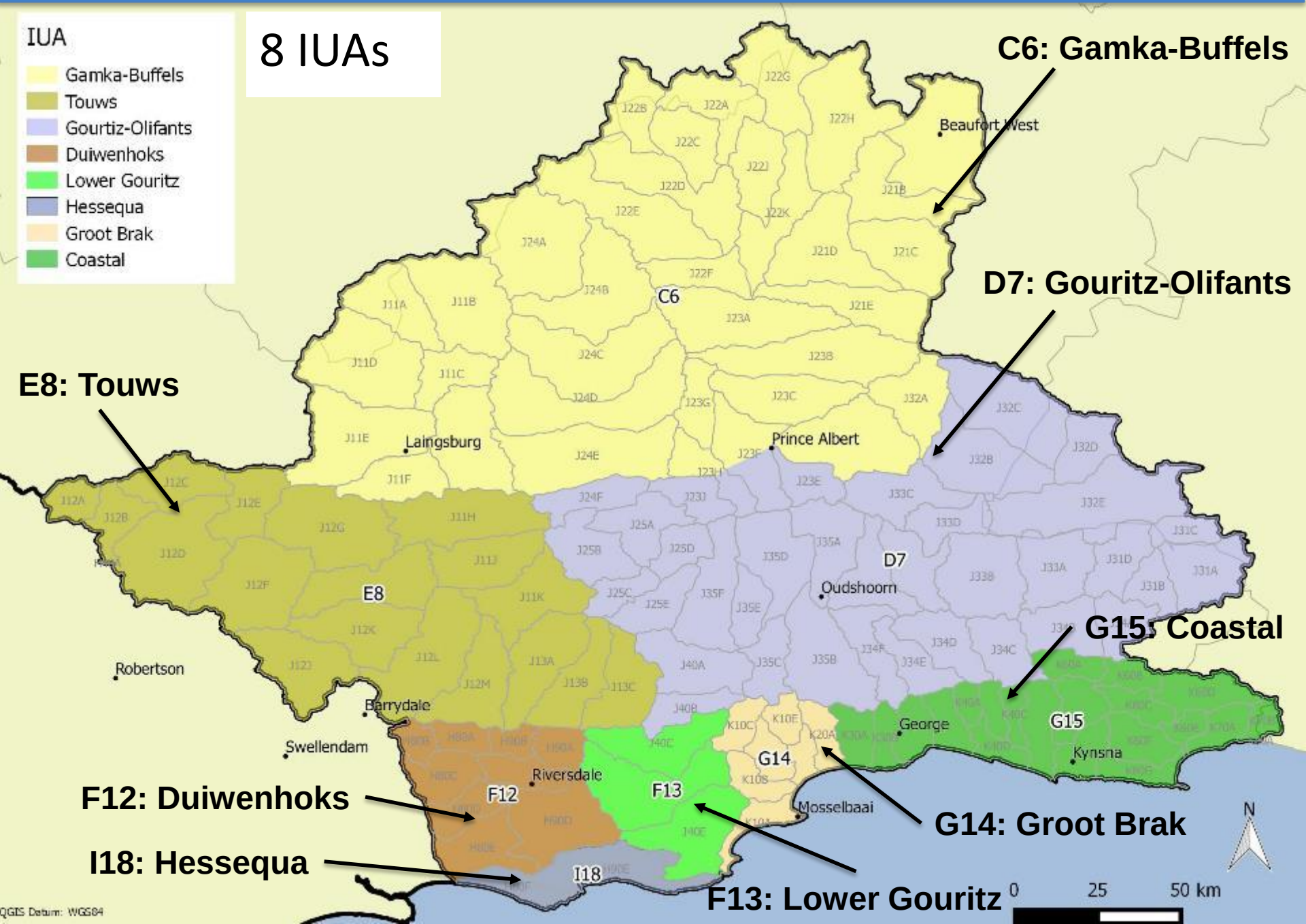
STEP 6: EVALUATE SCENARIOS WITH STAKEHOLDERS

Outcome: Scenario configuration

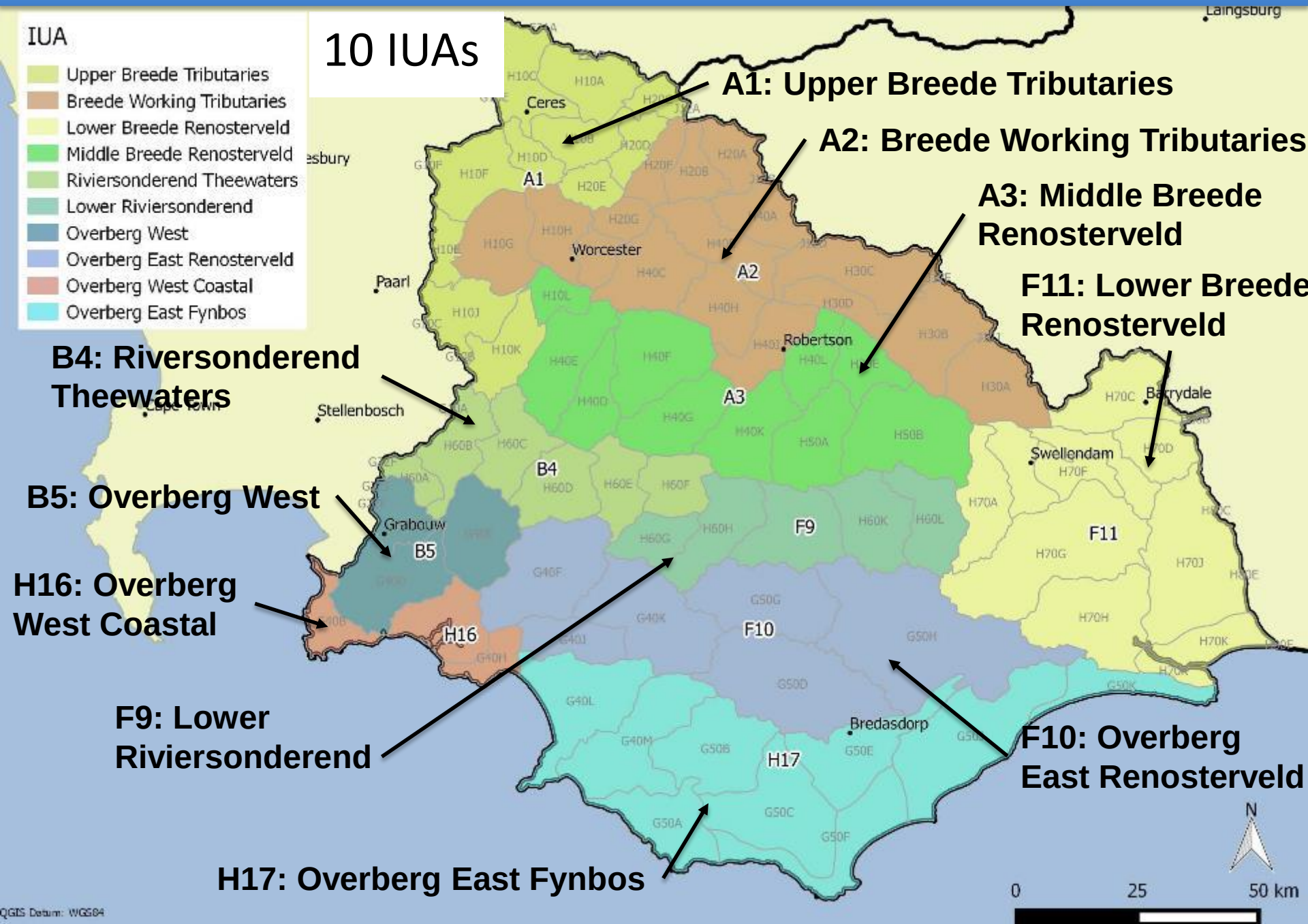
STEP 7: GAZETTE WATER RESOURCE CLASS CONFIGURATIONS

Outcome: Gazetted WRCs

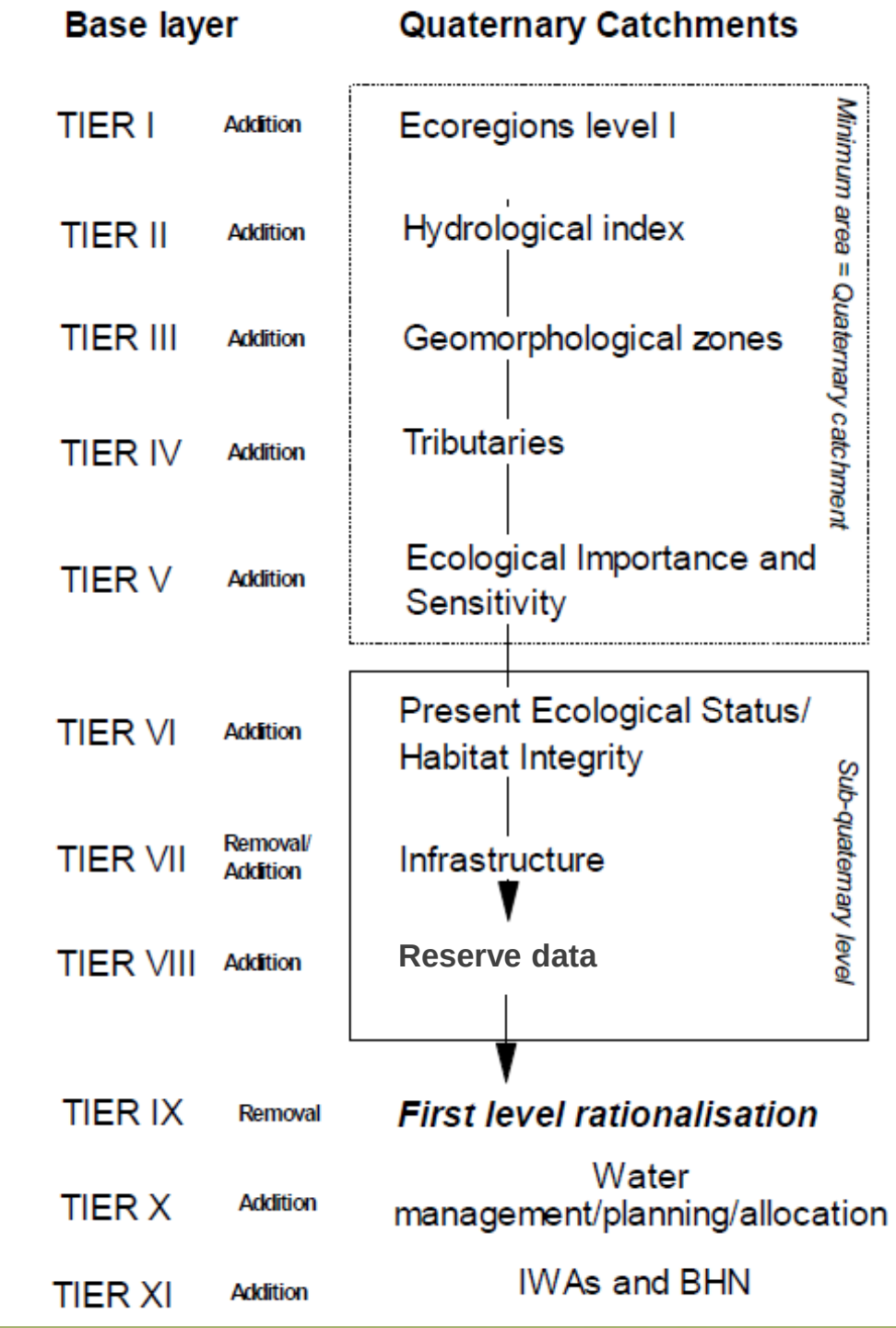
Gouritz Integrated Units of Analysis



Breede-Overberg Integrated Units of Analysis



River Nodes



Methodology (DWAF, 2007):

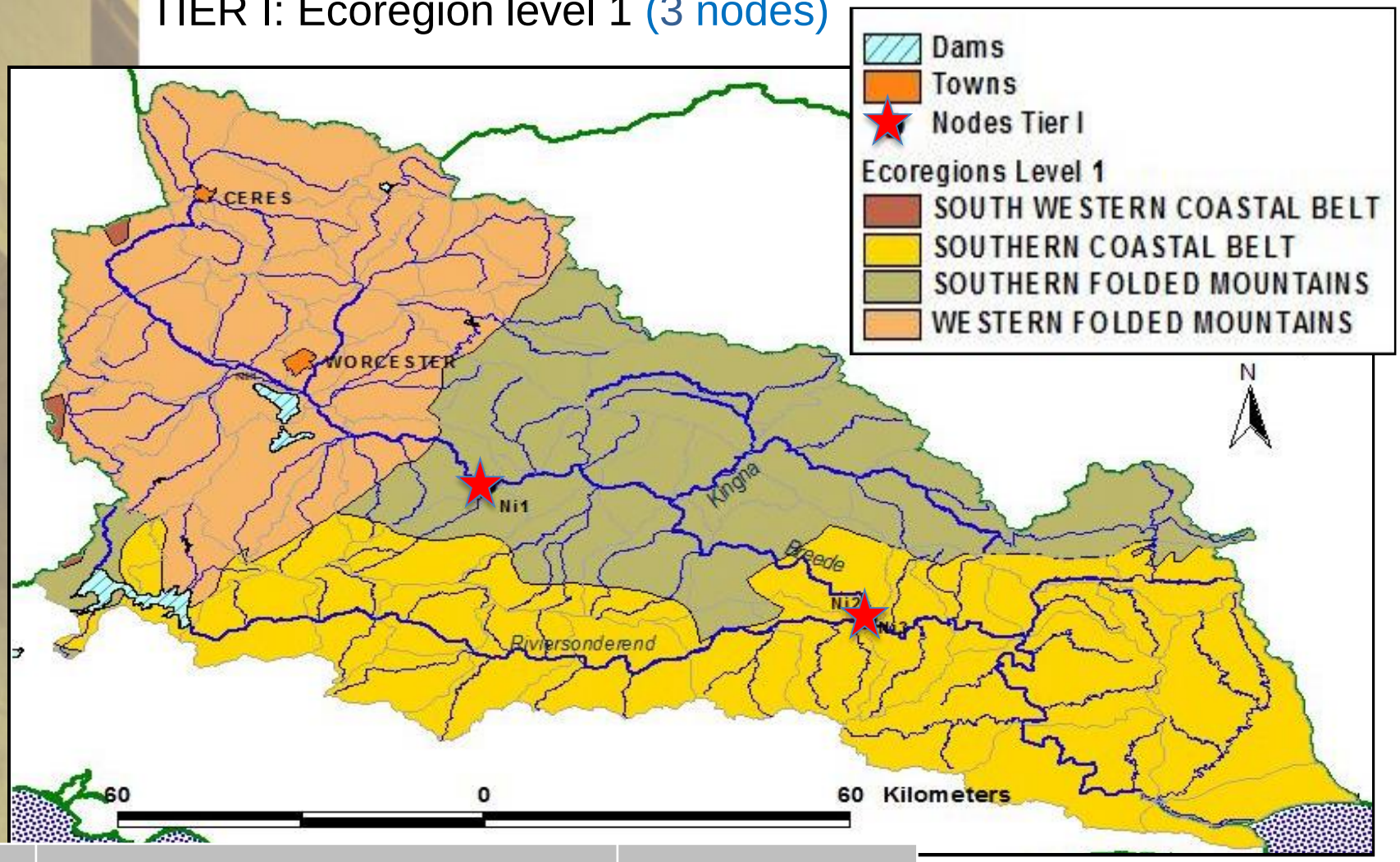
- Eleven "tiers" of rules used to establish river nodes.

Nodes:

- 148 river nodes in the Gouritz sub-area
  - (66 scenario modelling)
- 114 river nodes in the Breede-Overberg sub-area
  - (76 scenario modelling)

River Nodes: Breede River Catchment

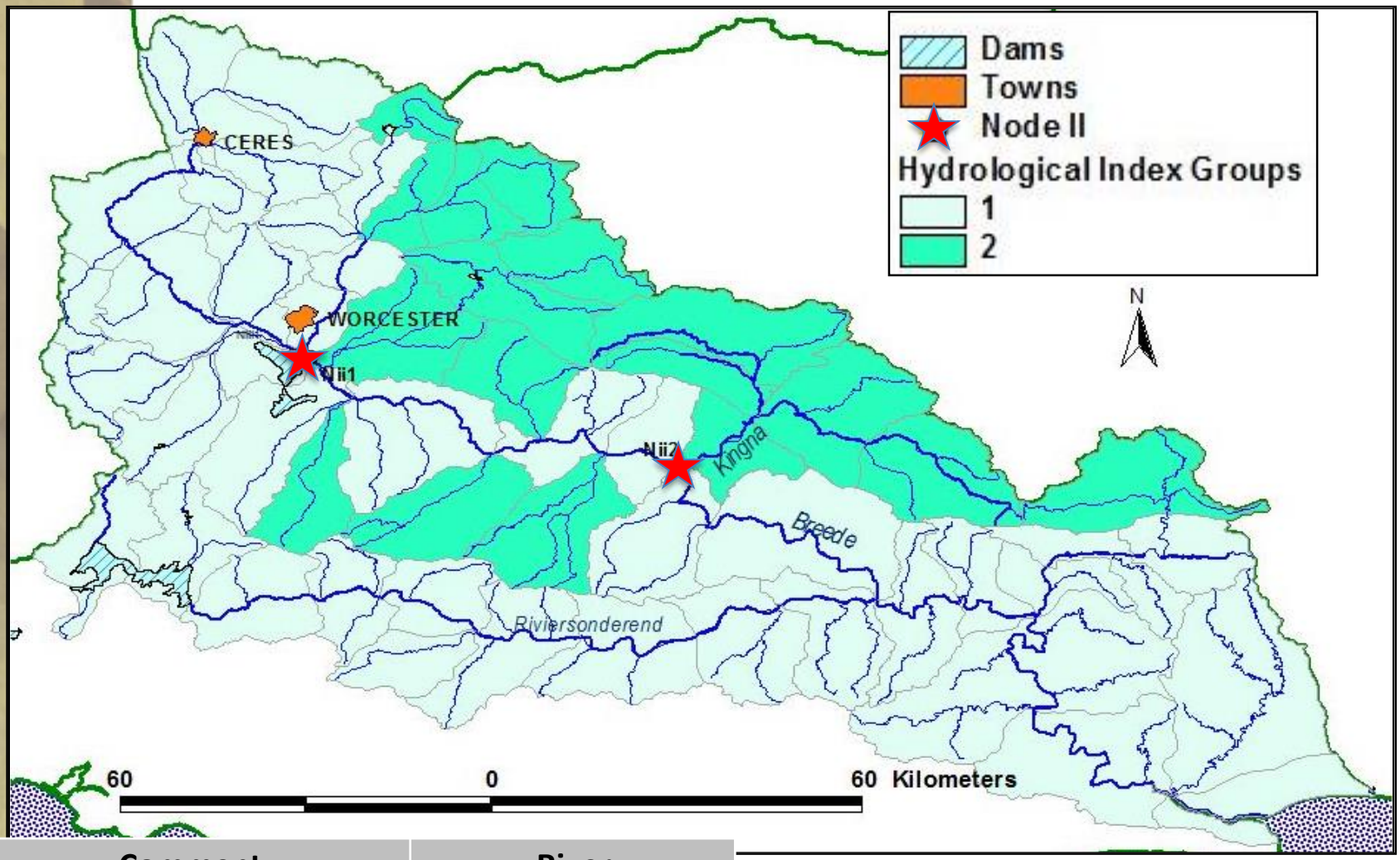
TIER I: Ecoregion level 1 (3 nodes)



Node	Comment	River
Ni1	U/s of confluence with Poesjenels	Breede
Ni2	U/s of confluence with Riviersonderend	Breede
Ni3	U/s of confluence with Breede	Riviersonderend

River Nodes: Breede River Catchment

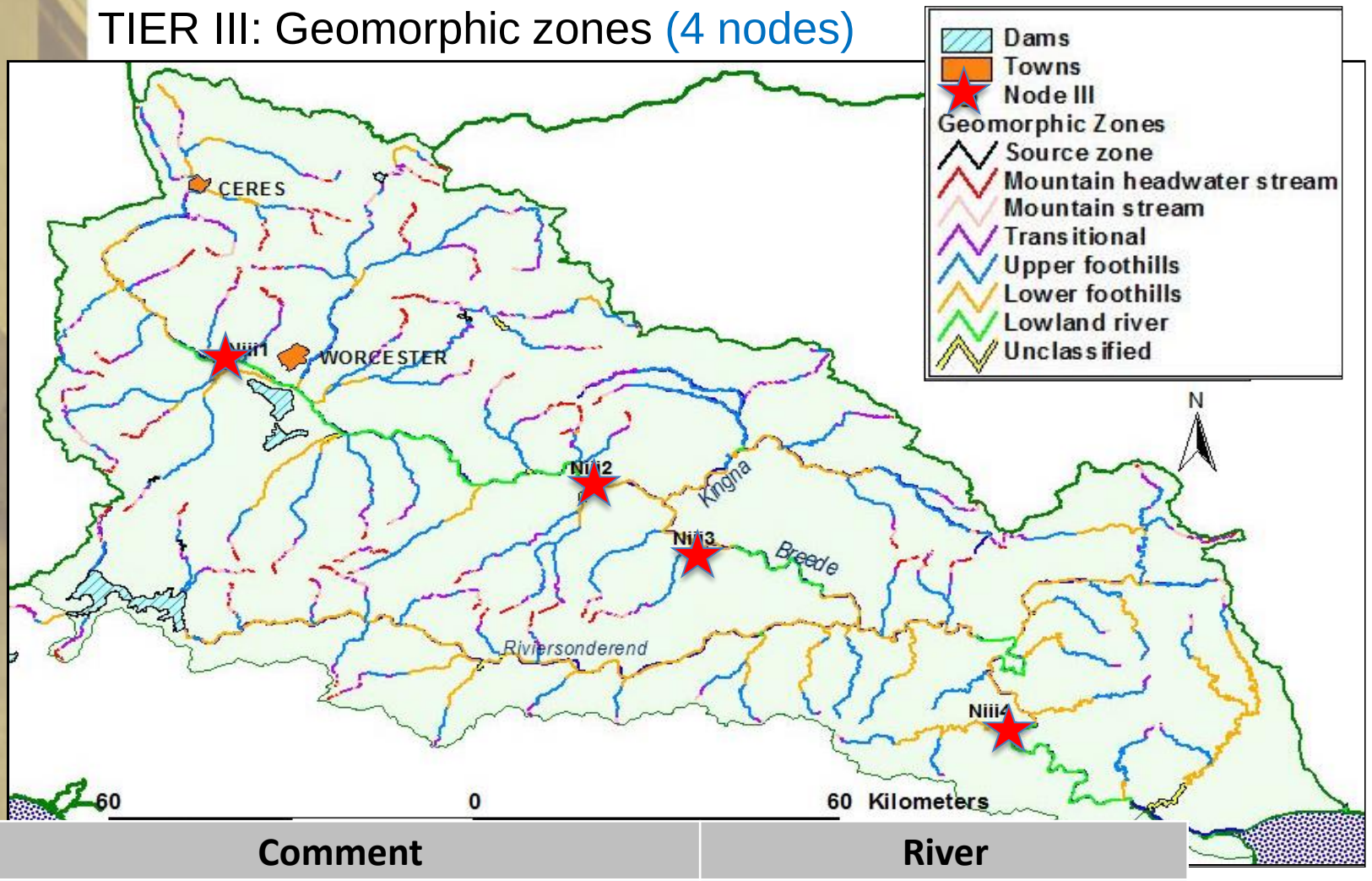
TIER II: Hydrological Index (2 nodes)



Node	Comment	River
Nii1	D/s of Hex/Breede confluence	Breede
Nii2	At gauging weir H3H011, u/s of confluence with Breede	Kogmanskloof/Kingna

River Nodes: Breede River Catchment

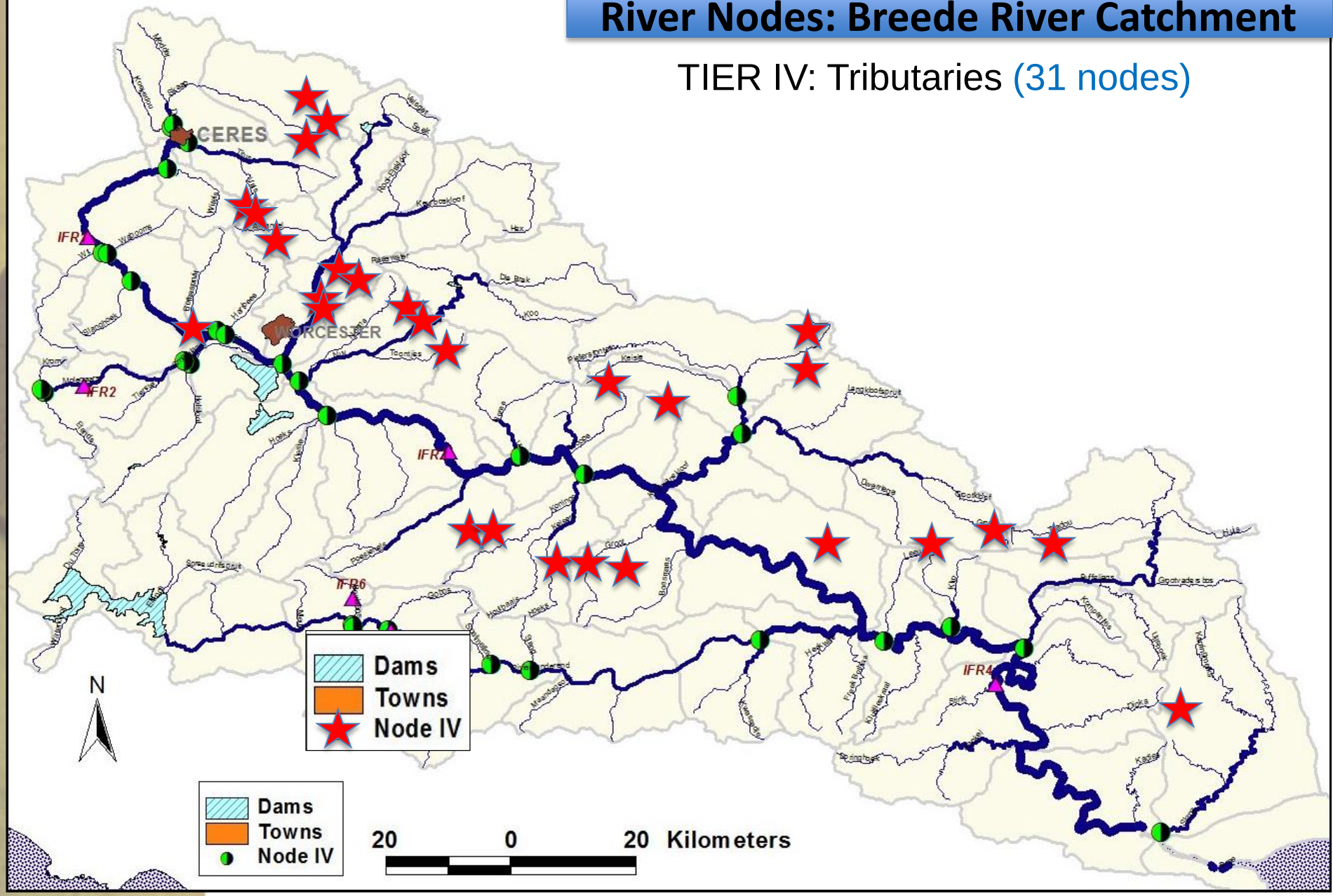
TIER III: Geomorphic zones (4 nodes)



Node	Comment	River
Niii1	U/s of confluence with Molenaars (Smallblaar)	Breede
Niii2	U/s of confluence with Breede	Breede
Niii3	U/s of confluence with Boesmans	Breede
Niii4	D/s of EWR 4, at Napkei confluence	Breede

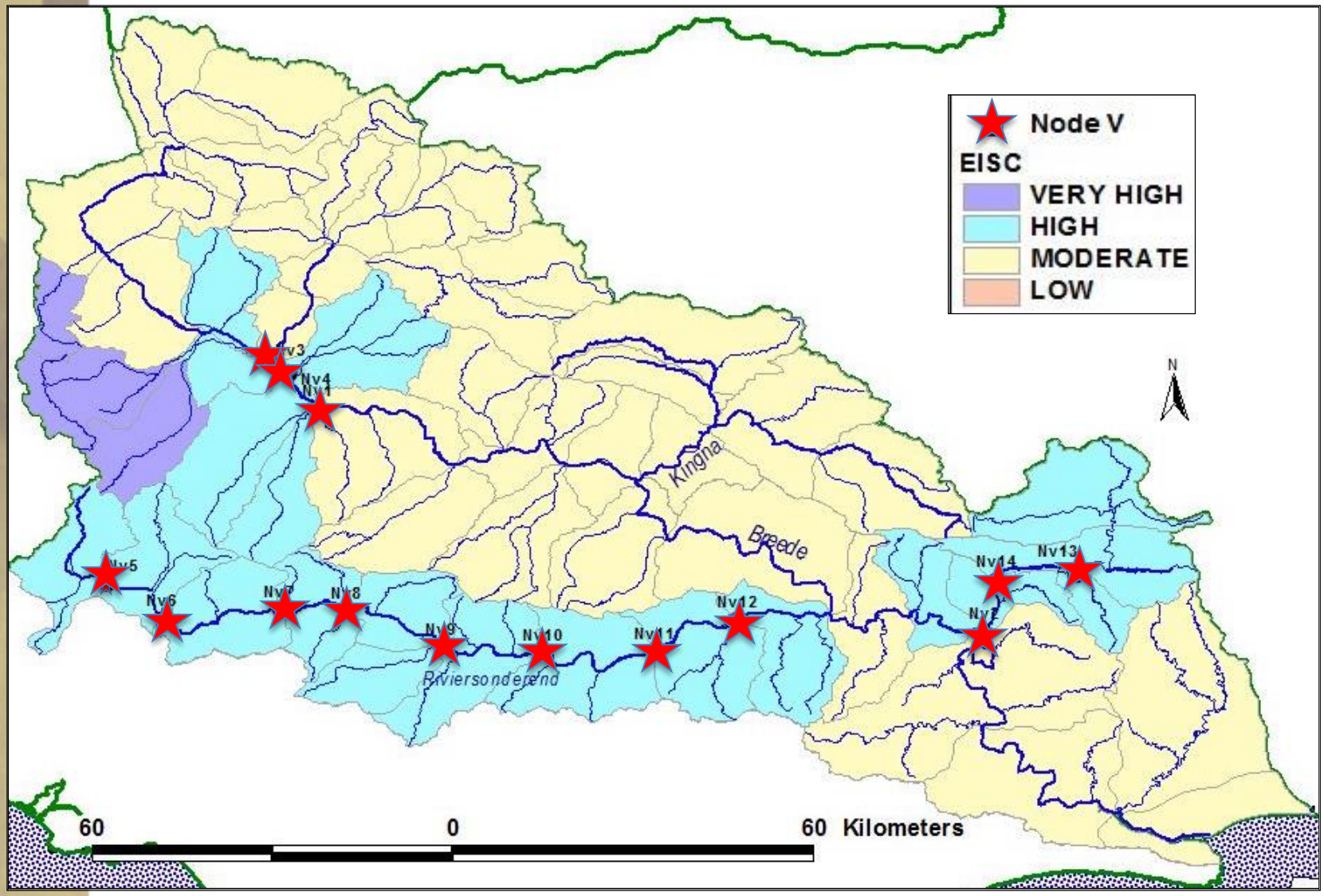
River Nodes: Breede River Catchment

TIER IV: Tributaries (31 nodes)



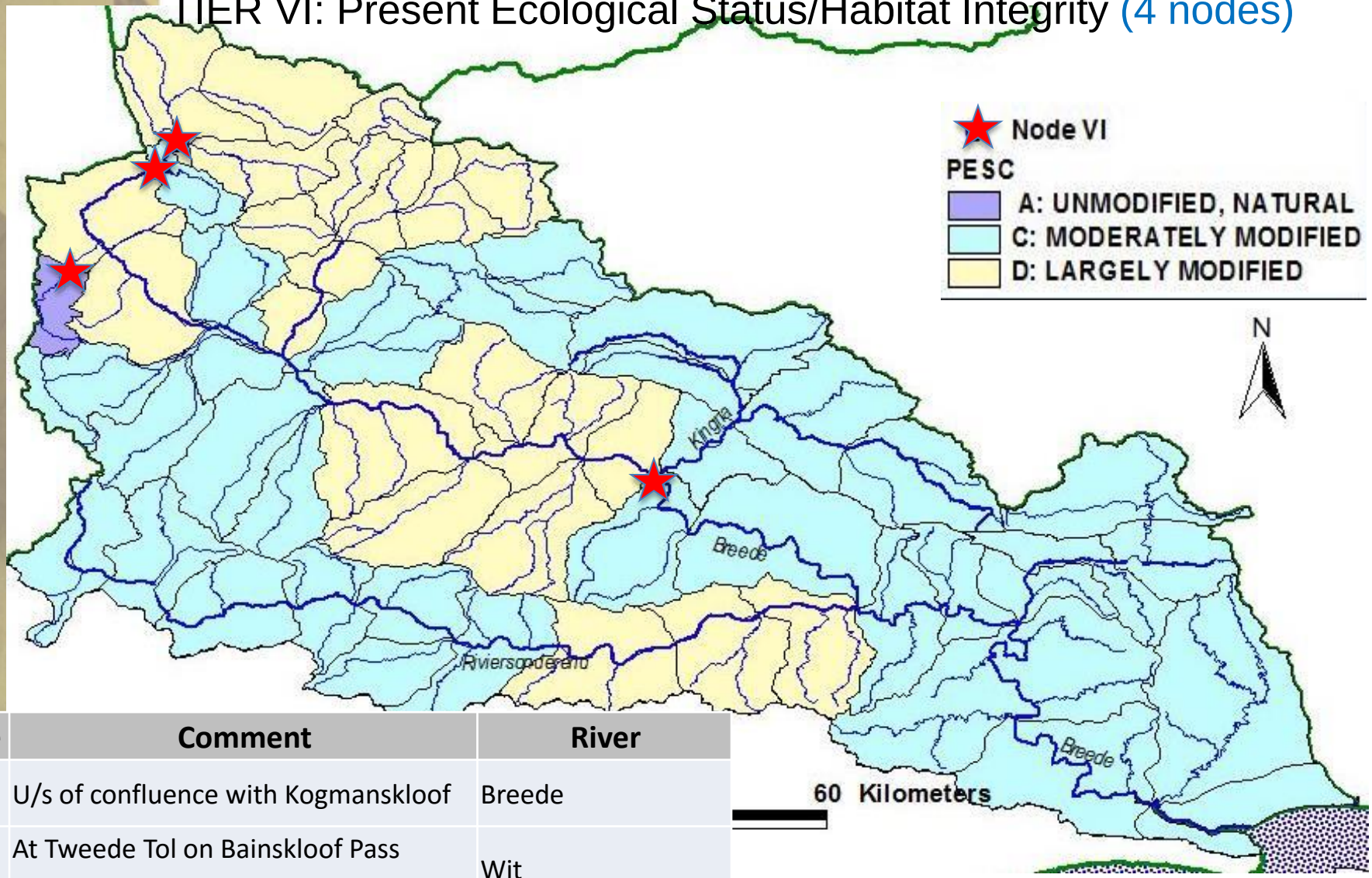
River Nodes: Breede River Catchment

TIER V: Ecological Importance and Sensitivity (14 nodes)



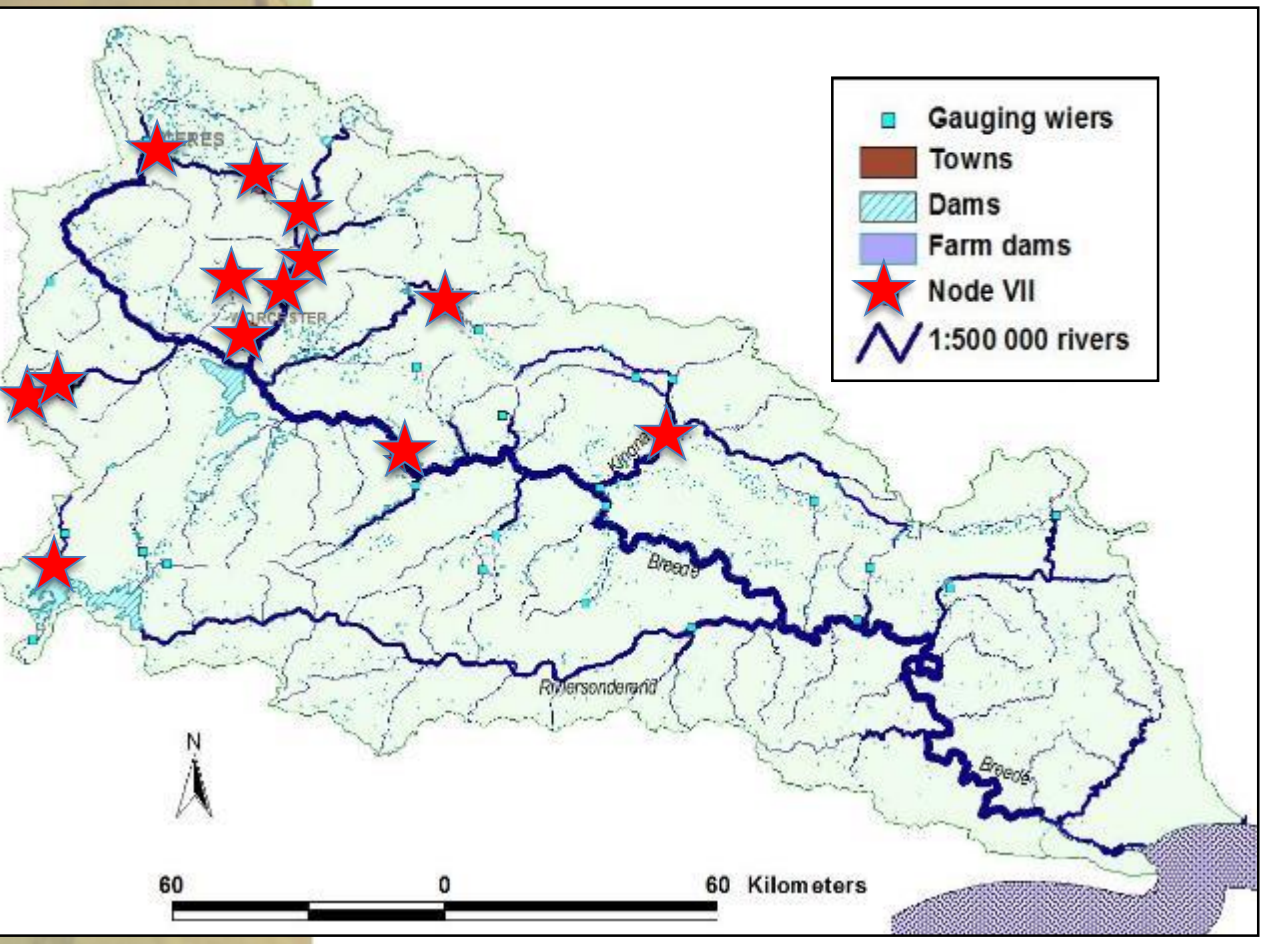
River Nodes: Breede River Catchment

TIER VI: Present Ecological Status/Habitat Integrity (4 nodes)



Node	Comment	River
Nvi1	U/s of confluence with Kogmanskloof	Breede
Nvi2	At Tweede Tol on Bainskloof Pass (R303)	Wit
Nvi3	U/s of junction of roads R46/R43	Breede
Nvi4	2 km d/s of confluence with Dwars/Titus	Breede

TIER VII: Infrastructure (9 nodes)



Reason	Nodes added
Gauging weirs	7
At the u/s limit of the inundation of any major dam	1
U/s of mines, towns or other localities likely to influence water quality	1
Where the area covered by farm dams in the u/s quaternary is more than five times that of the d/s quaternary	0
On a river immediately u/s of the confluence with an IBT	0

Node	Comment
Nvii2	At gauging weir H1H018, EWR 2
Nvii3	At gauging weir H1H016, u/s of confluence with Titus
Nvii4	At gauging weir H2H005, 7 km West of Hex River Valley
Nvii5	At gauging weir H4H008, 2.3 km North of Worcester

Node	Comment
Nvii6	At gauging weir H1H020, 7.5 km North of Worcester
Nvii7	At gauging weir H2H006, North of Worcester on N1
Nvii8	At gauging weir H4H017, EWR 3
Nvii9	U/s of confluence with Kogmanskloof
Nvii10	U/s of Theewaterskloof Dam

TIER VIII: Reserve Data (1 nodes)

- EWR Site 1 only additional node (other EWR sites already have nodes)

SITE	NAME	Node	Comment
EWR 1	D/s of confluence with Wabooms, nearest quat boundary to EWR1	Nviii1	H10F boundary
EWR 2	Molenaars d/s of gauging weir H1H018	x	Nvii2 already in place
EWR 3	Breede u/s of la Chasseur	x	Nvii8 already in place
EWR 6	Baviaans u/s of gauge above Genadendal	x	Niv28 already in place
EWR 5	Riviersonderend near Greyton (campsite)	x	Nv9 already in place
EWR 4	Lower Breede u/s of Stink, d/s Felix Unite camp	x	Niii4 already in place

Nodes removed:

- Nv5 and Nv6 removed (impacted by dam)
- Nv14 (moved upstream of dam)

TIER IX: First level rationalisation

- Niii2, Nv1, Nv4 deleted (close to other nodes)

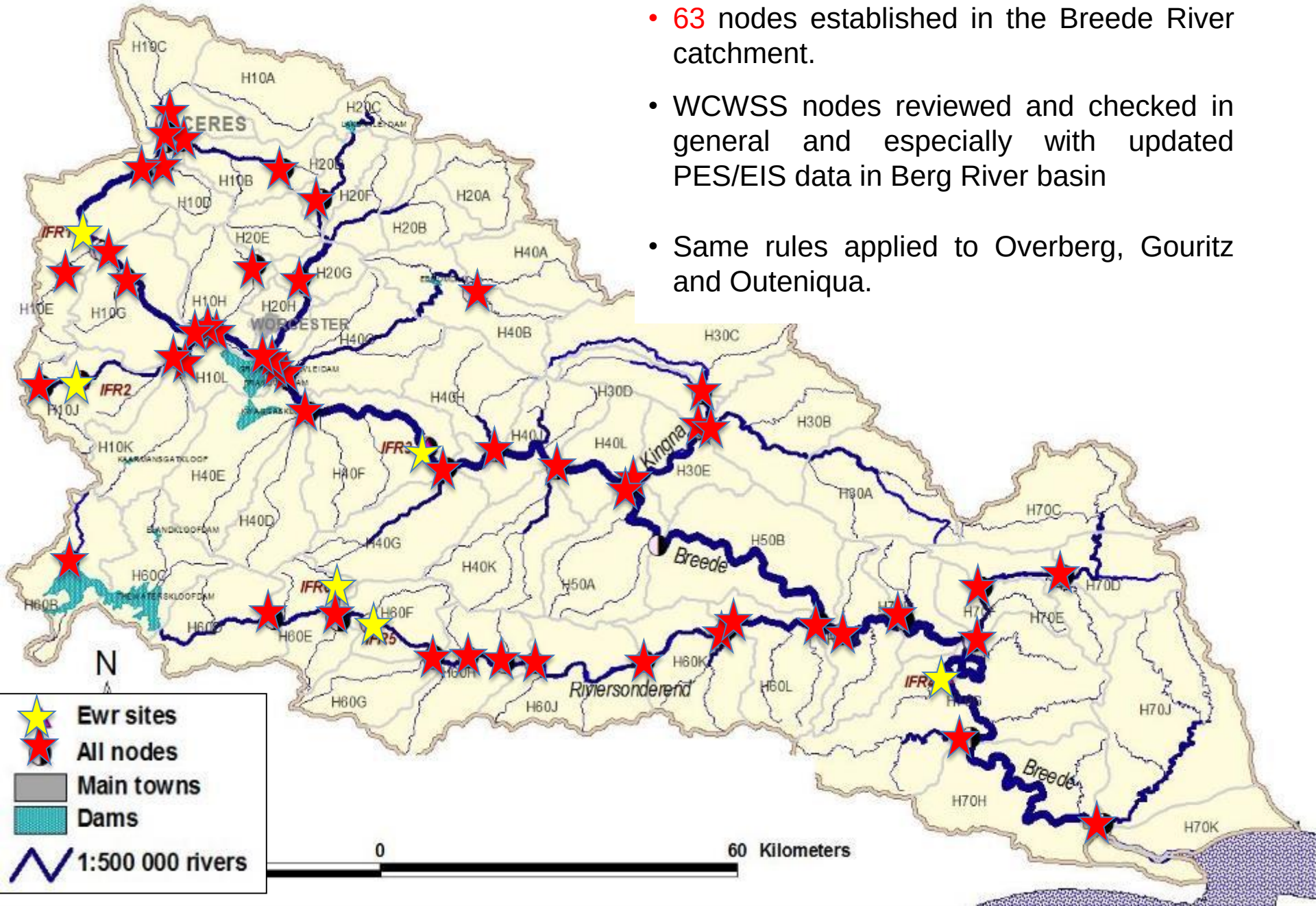
TIER X: Water resources management, planning or allocation requirements

- No nodes added in Tier X

TIER XI: International water agreements

- No nodes added in Tier XI

- 63 nodes established in the Breede River catchment.
- WCWSS nodes reviewed and checked in general and especially with updated PES/EIS data in Berg River basin
- Same rules applied to Overberg, Gouritz and Outeniqua.



Study Status

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Outcome: IUA & nodes

STEP 2: LINK VALUE & CONDITION OF WATER RESOURCE

Outcome: How economic value & social wellbeing influenced by ecosystem char. & use of water

SOCIAL WELL BEING

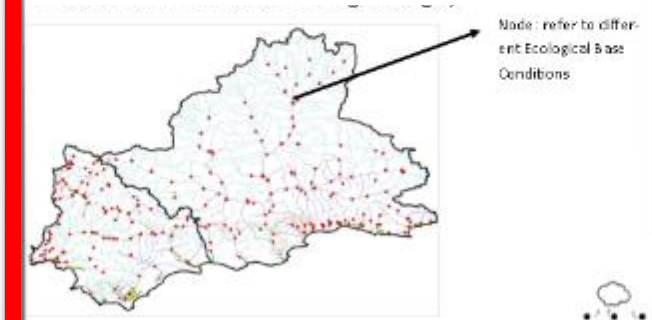
ECOSYSTEM INDEX

ECONOMIC PROSPERITY

STEP 3

STEP 3: QUANTIFY THE ECOLOGICAL WATER REQUIREMENTS & CHANGES IN EGSAs

Outcome: EWR node table



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Outcome: Gazetted WRCs

Updated Hydrological Data

Incorporating Biophysical Nodes:

- WR2012 configurations sub-divided to reflect nodes
- Current and natural flows calculated for all nodes
- EWRs for 66 (Gouritz) and 76 (Breede) nodes based on natural flows
- EWRs determined for 26 estuaries
  - (19 Reserve studies undertaken in this study)

STEP 3: Quantify EWRs & changes in non-water quality EGSAs

- Step 3a:
  - Identify nodes to which existing river Reserve data can be extrapolated, and extrapolate
- Step 3b:
  - Develop rule curves, summary tables and modified time series for all nodes for all categories
- Step 3c:
  - Quantify changes in relevant ecosystem components, functions & attributes for each category for each node

- Will consider groundwater contribution to baseflow, wetlands connnected to surface and groundwater and water quality

Determining EWRs

- Desktop Reserve Model:
- Assumes the EWRs decrease from ecological category A - D
- Uses Reserve flow estimates to calibrate flows at other points of interest, if suitable, or generates modelled estimates based on generic hydrological relationships per quaternary catchment
- Calculates monthly volumes or mean monthly discharge (seasonal distribution) for:
  - Maintenance low and high flows
  - Drought low and high flows
- EWRs for each node comprise:
- a summary table (*.tab)
- a rule curve (*.rul)
- the time series of monthly flows (*.mrv)

Existing EWR information from previous studies

EWR related data for Breede and Overberg:

- Intermediate Reserve determination study (DWAF 2003)
  - **6 river sites**
- Palmiet River instream flow assessment study (DWAF 2000) - Intermediate
  - **4 river sites**
- Intermediate Reserve determination study for the Hex River (DWAF 2002)
  - **3 river sites**

EWR related data for Gouritz and Outeniqua:

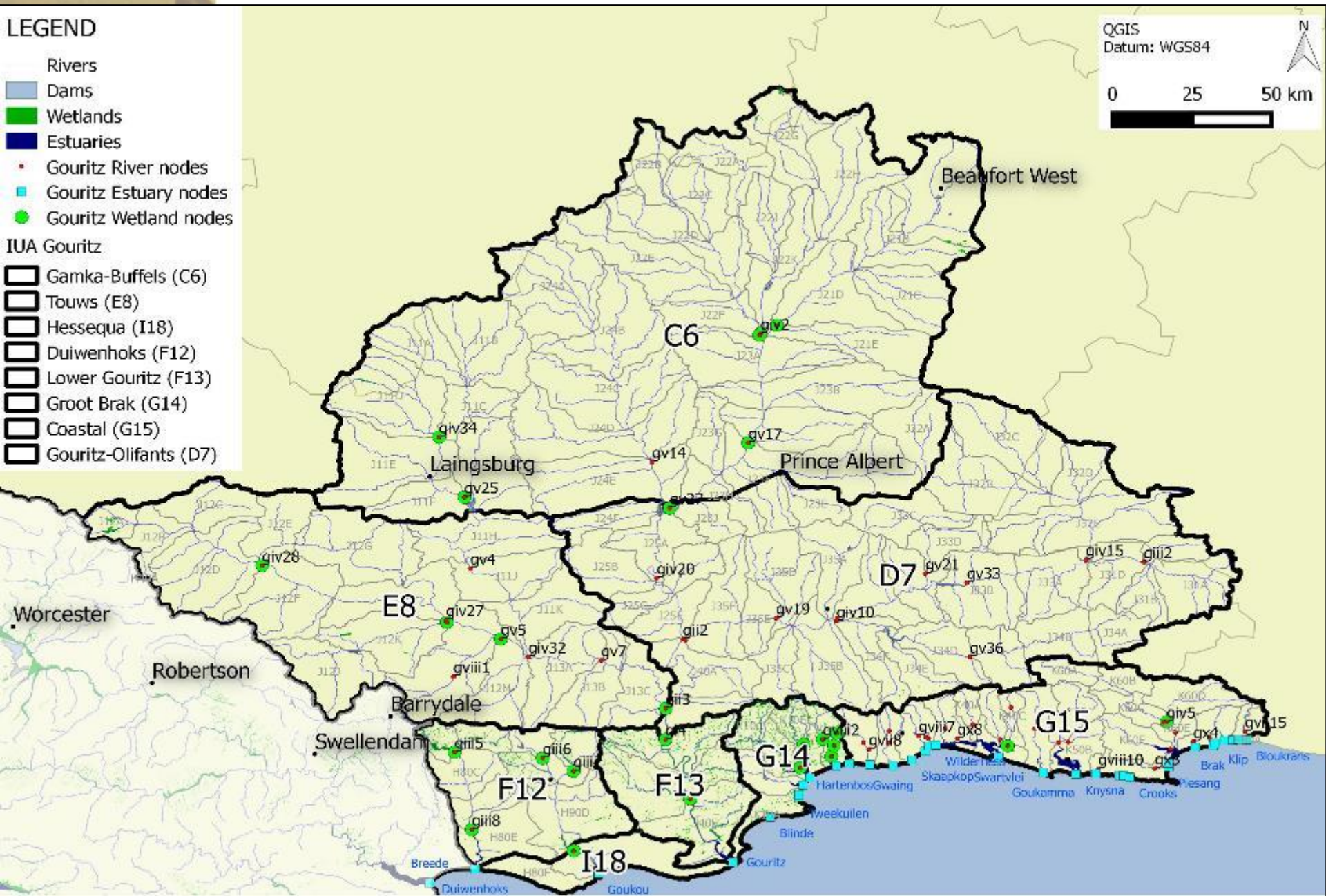
- Intermediate and Rapid Reserve determination studies for the Gouritz River basin (DWS 2014, DWS 2015)
  - **5 Intermediate and 5 Rapid river sites**
- Outeniqua Ecological Water Requirements study (DWAF 2009, DWAF 2010) – Intermediate and Rapid
  - **8 Intermediate and 8 Rapid river sites**

EWR data summary Breede River EWR site 1

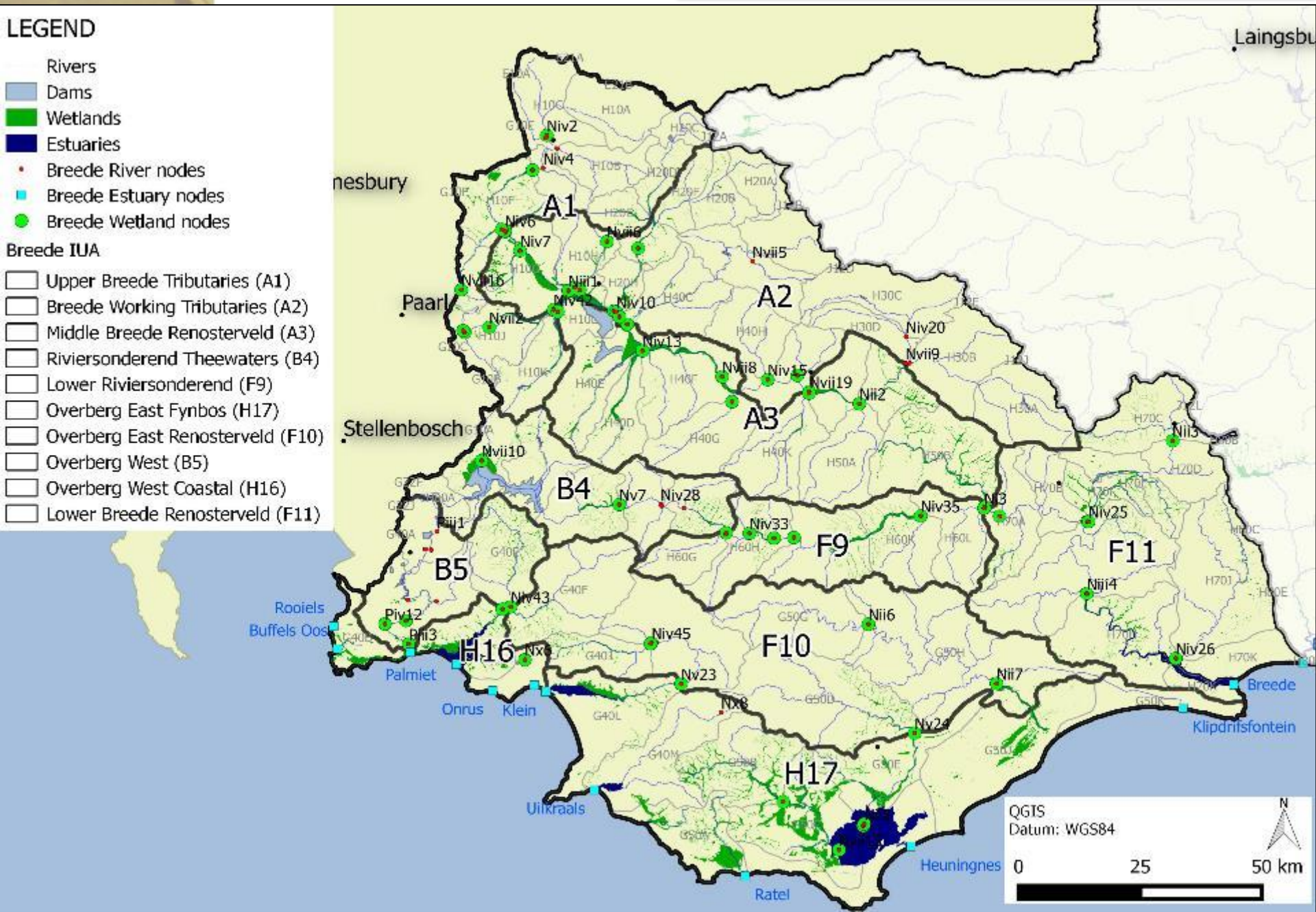
COMPONENTS	PES	TRAJ	SHORT TERM (5y)	LONG TERM (20y)	EIS	EC
Hydrology	D	0	D	D	MODERATE	
Water quality	B	-	C	C		B
Geomorphology	D/E	0	D/E	D/E		D/E → D
Riparian veg	D/E	-	E	E/F		D/E → D
Fish	D/E	-	E	F		D/E → D
Aquatic inverts	D/E	0	D/E	D/E		D
Ecostatus	D/E	0	D/E	E		D/E
					Long term EC	D

Concern based on landuse information or inconsistency between the bio-assessment and the water chemistry (i.e biota in a lower class)

Nodes: (Gouritz) 76



Nodes: (Breede) 65



Refer to node table with all relevant information

Refer to printed EWR table i.e.

EWR site for calibra-tion	IUA	#	SQ code	CODE	RIVER	LONG	LATI	QUAT	ER	HI	GZ	EISC	nMAR	2014 EC	EWR %	EWR MAR
WK	E8	4	J12D-08735	giv28	Touws	20.2714	-33.4567	J12D	SFM	3	UF	H	16.4	D	11.3	1.8
WK	E8	8	J12H-08834	giv27	Touws	20.9021	-33.6208	J12H	SFM	3	UF	M	26.4	B	26.8	7.1
EK	E8	10	J12K-08887	giv26	Brak	20.9042	-33.6280	J12K	SFM	3	UF	H	2.9	C	17.7	0.5
G7 (EK)	E8	11	J12L-08985	gviii1	Doring - EWR 7 - C/D	20.9274	33.7904	J12L	SFM	3	UF	H	2.9	D	12.0	0.4
G3 (EK)	E8	12	J12M-08904	gv5	Touws - EWR 3 - C	21.0896	-33.6779	J12M	SFM	3	UF	H	33.5	D	17.8	6.0

Other nodes

EWRs for Estuaries

- RDM Studies have been conducted for 19 of the 26 significant estuaries, and 2 of the micro-estuaries
  1. Onrus
  2. Rooiels
  3. Heuningnes

Required Reserve

Rooiels

Onrus

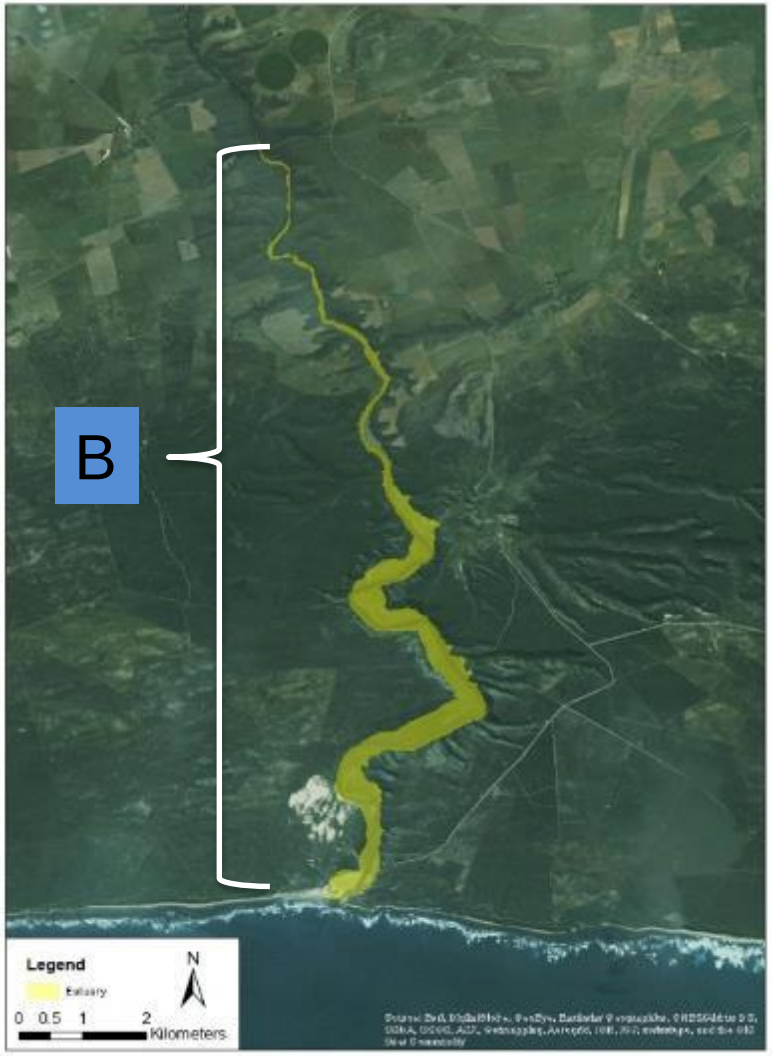
EWRs for Estuaries

- There are estimates of % MAR and PES for all but two of the estuaries in the study area
  - all the estuaries included in the 2012 National Biodiversity Assessment
- Both health assessments and RDM studies involve scoring the present day situation using the Estuary Health Index (EHI)
- RDM studies also include a number of flow scenarios for estuaries are also scored using the EHI

Estuaries Reserve:

Estuary	Reserve (Scenarios)	PES	REC
Rooiels	Yes 4	B	B
Buffels (Oos)	-	B	B
Palmiet	Yes 7	C	B
Bot/Kleinmond	Yes 3	C	B
Onrus	Yes 5	E	D
Klein	Yes 7	C	B
Uilkraals	Yes 4	D	C
Ratel	-	C	C
Heuningnes	In Prog 5	D	A
Klipdrifsfontein	-	A	A
Breede	Yes 5	B	B
Duiwenhoks	Yes 5	B	A
Goukou	Yes 5	C	B
Gouritz	Yes 5	C	B
Blinde	-	B	B
Tweekuilen	-		
Gericke	-		
Hartenbos	-	D	C

Estuary	Reserve (Scenarios)	PES	REC
Klein Brak	Yes 5	C	C
Groot Brak	Yes 10	E	C
Maalgate	-	B	B
Gwaing	Yes 5	B	C
Kaaimans	-	B	B
Wilderness	Yes 5	B	A
Swartvlei	Yes 8	B	B
Goukamma	Yes 8	B	A
Knysna	Yes 10	B	B
Noetsie	-	B	A
Piesang	-	C	B
Keurbooms	Yes 5	A	A
Matjies	Yes 5	B	B
Sout (Oos)	Yes 5	A	A
Groot (Wes)	-	B	A
Bloukrans	-	A	A



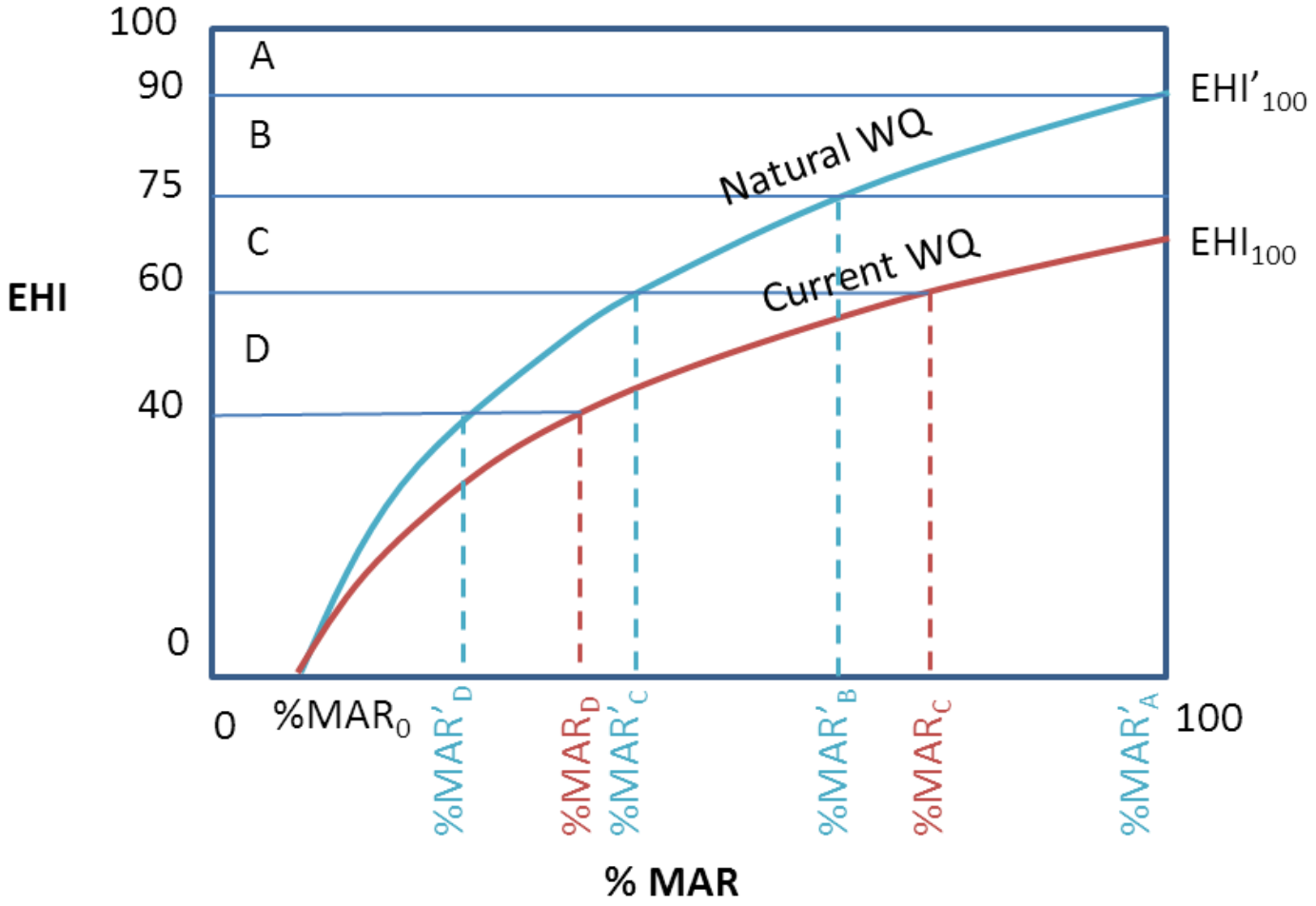
Duiwenhoks Estuary

- *Delineation of the Duiwenhoks estuary was based on the National Estuary Layer.*
- *The Estuary Functional Zone was estimated at 419.3 ha and the open water area at 108.3 ha.*

1. Determine existing data available
2. Estimate Ecological Water Requirement thresholds

Estuary	Type	Area (ha) incl. floodplain	Channel area	Catchment size (km²)	Present day MAR Mm³	RDM (Scenarios)	PES	REC
Duiwenhoks	Open	419.33	108.3	1207	81.62	Yes 5	B	A

Calculating EWRs for Estuary sites



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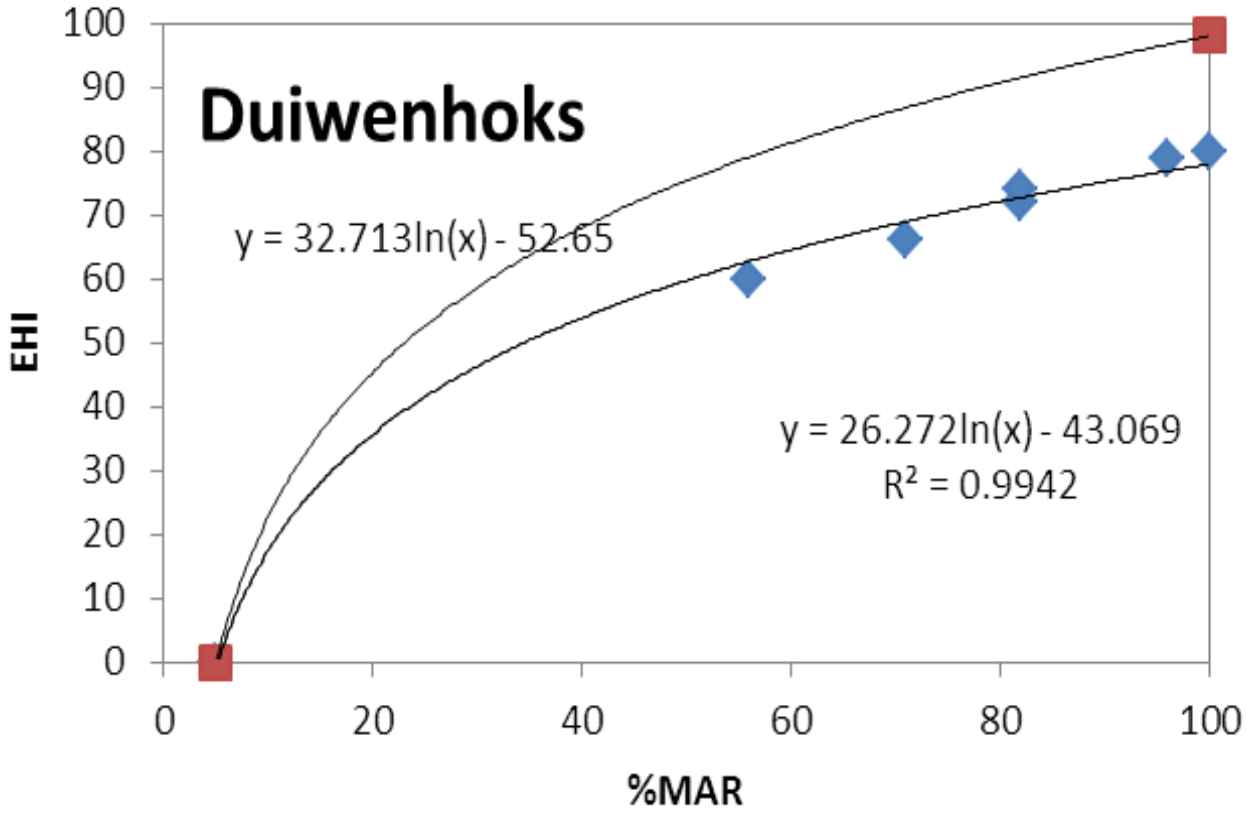


%MAR thresholds	E/D threshold		D/C threshold		C/B threshold		B/A threshold	
	Fixed WQ	Current WQ	Fixed WQ	Current WQ	Fixed WQ	Current WQ	Fixed WQ	Current WQ
Duiwenhoks	**17**	**24**	**31**	**51**	**50**	**89**	**78**	**n/a**

Groundwater link to EWRs

GWBF: Groundwater contribution to baseflow

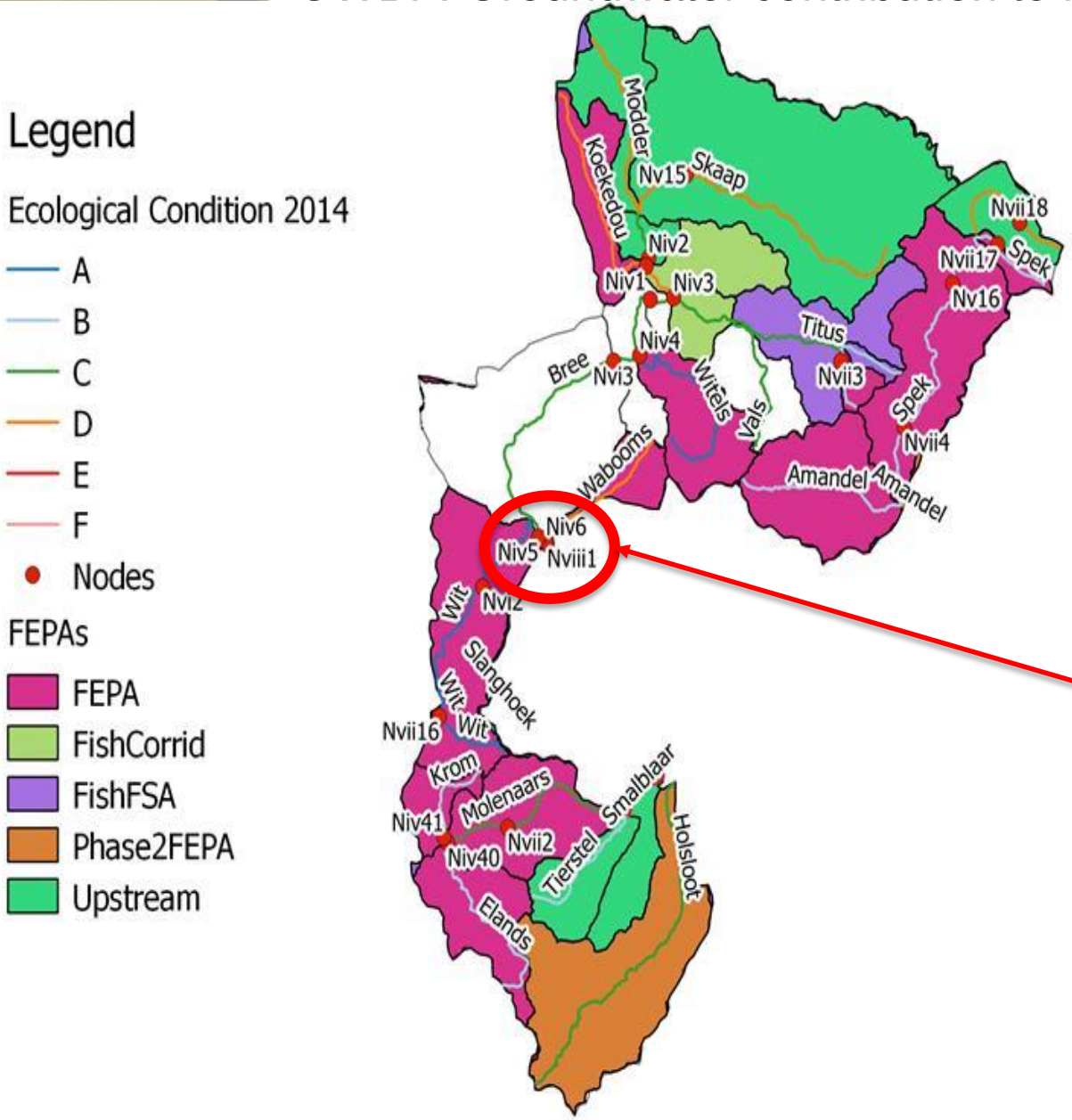
Node	EWR MAR (Mm^3/a)	Final GWBF (Mm^3/a)	GWBF/EWR
Nii1	210.3	0.00	0%
giv34	3.5	0.00	0%
gv25	5.6	0.00	0%
gv4	3.1	0.00	0%
giv32	3.5	0.00	0%
giv3	8.7	0.00	0%
giv1	1.3	0.00	0%
giv2	3.1	0.00	0%
gv17	13.1	0.00	0%
….			
Niv26	1.4	1.43	102%
gviii7	2.3	2.43	106%
Nii4	2.3	2.53	110%
Nv24	2.1	2.55	121%
gx8	0.4	0.59	149%
Niv45	1.3	1.97	152%
Nx8	0.5	0.79	158%
Ni4	1.6	3.47	217%
Nii6	0.5	1.43	287%

Median GWBF/ERW	11%
Range (%)	Count of quaternary's
0-11	70
12-75	50
>75	19

- GWBF/EWR indicates relative role GWBF has in meeting EWR
- Relationship used to determine groundwater balance equation applied

Groundwater link to EWRs

GWBF: Groundwater contribution to baseflow



- Groundwater EWR for nviii1:
  - 0.81 Mm^3/a GWBF
  - 136 Mm^3/a EWR MAR
  - 1% GWBF/EWR

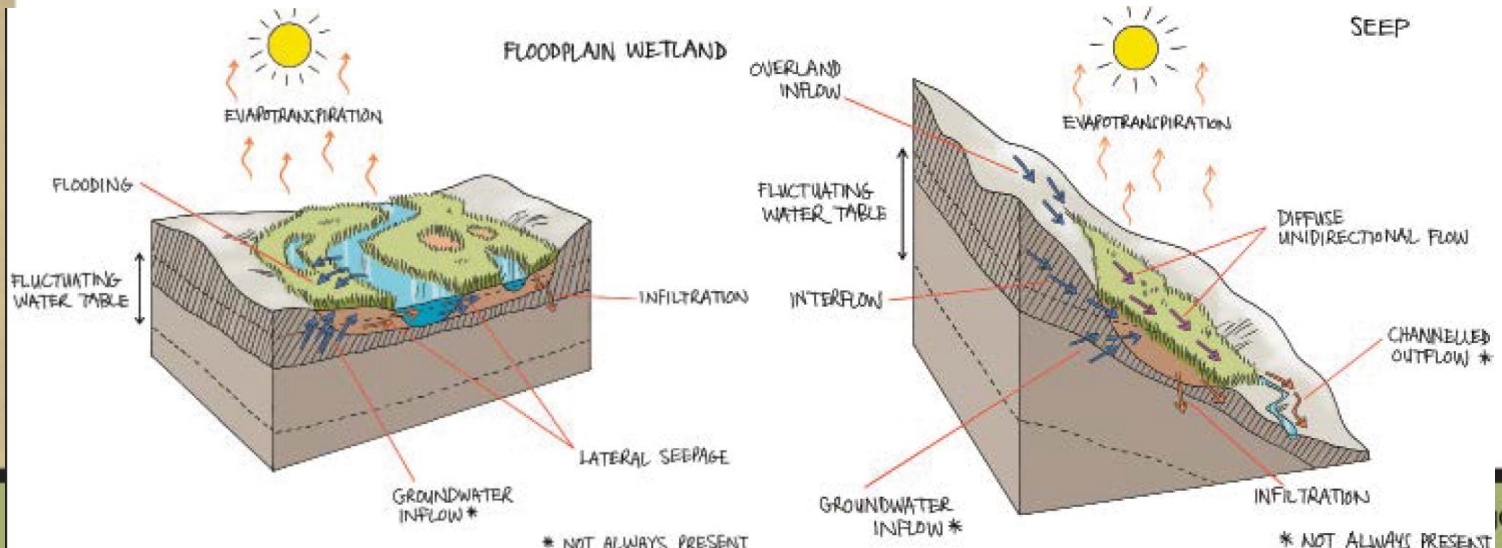
Example node

Wetland link to EWRs: Surface water

1. Determine spatial distribution of wetlands
2. Identify wetland types
3. PES/EIS of catchments & Wetland Resource Units
4. Identify wetland priorities based on ecological status
5. Refine considering resource demand & risks

Wetland link to EWRs: Surface water

1. Spatial distribution
   - NFEPA
   - Conservation Plans (Fine Scale Planning)
2. Identify wetland types
   - Hydrogeomorphic Units
     i.e. Floodplain, Seep etc.
3. PES/EIS from existing studies
   - i.e. Fine Scale Planning; Reserve studies



Water Quality link to EWRs

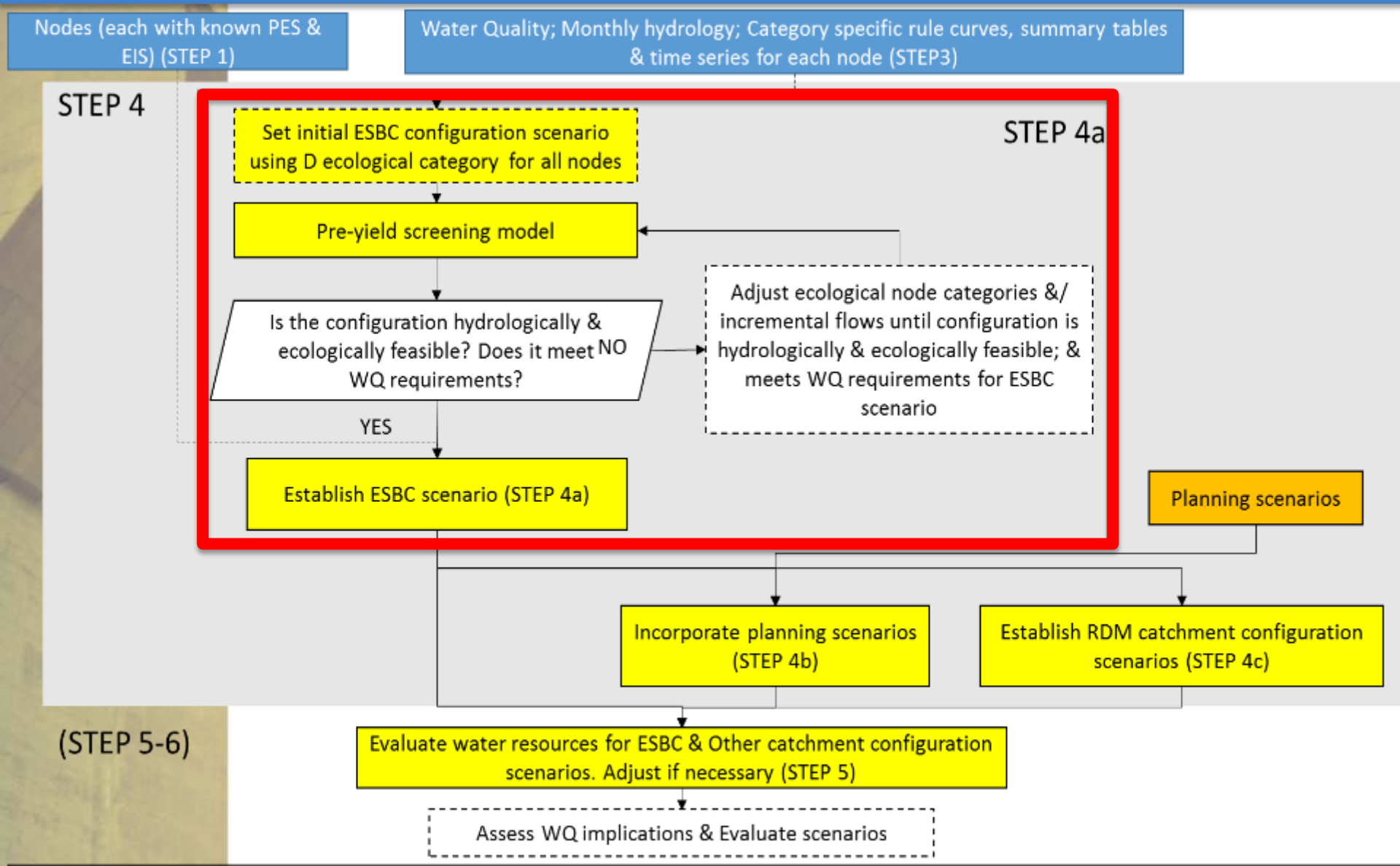
- In preparation for the scenario analyses, water quality monitoring points and flow gauging stations associated with the IUAs and nodes were identified

- Determine relationships between key water quality constituents and flow, to determine the water quality consequences of different flow and development scenarios

NODE	QUAT	WQ Point	Description	Type	n	Flow gauge
Niv5	H10F	102021	Wit River at Drosterskloof (NCWQ)	Rivers	1275	H1H007
Niv6	H10F					
Nviii1	H10F					
Niv40	H10J	102028	At Hawequas Forest Reserve on Elandsrivier	Rivers	699	H1H017

Next step

Step 4: Set a baseline for ecological sustainability- Overview



Discussion

Wetland link to EWRs

Wetlands linked to Surface Water (river and estuary):

- **Non-isolated subsystems**
  - Channel (river)
  - Floodplain
  - Valley bottom

IUA	Node	Quat	Description	Associated wetlands	HGM	Hydroperiod	PES	EIS	Source
E8	giv28	J12D	U/s confluence Touws Kragga	Bokke River Vlei*	Channelled Valley Bottom	No information	AB	-	EGI
				Verkeerdevlei*	Channelled Valley Bottom	No information	AB	-	EGI
					Channelled Valley Bottom	No information	AB	-	EGI
					Floodplain	No information	C	-	EGI
	giv27	J12G	U/s confluence Touws Brak	Prinsrivier Dam* below Anysberg Nature Reserve	Channelled Valley Bottom	No information	Z3	-	EGI
	giv26	J12K	U/s confluence Touws Brak	Wetland within Eyerpoort Nature Reserve	Channelled Valley Bottom	No information	AB	-	NFEPA
					Channelled Valley Bottom	No information	C	-	NFEPA
					Flat	No information	C	-	NFEPA

Wetland link to EWRs

Wetlands linked to Groundwater (river and estuary):

- **Non-isolated subsystems**
  - Seep with channelled outflow
  - Depression linked to a channel
- **Isolated subsystems**
  - Isolated depression
  - Seep with channelled outflow

IUA	Node	Quat	Description	Associated wetlands	HGM	Hydroperiod	PES	SOURCE
H17		G40L	Klein Estuary					
	Nx8	G40M			Seep	Unknown	C	NFEPA
		G40M	Uitkraals Estuary		Seep	Unknown	AB	NFEPA
					Valleyhead Seep	Unknown	Z1	NFEPA
		G50A	Ratel Estuary	Ratel River#	Valleyhead Seep	Unknown	C	NFEPA
					Depression	Unknown	AB	NFEPA
		G50F	Heuningnes Estuary		Valleyhead Seep	Unknown	C	NFEPA
					Depression	Unknown	C	NFEPA
					Seep	Unknown	C	NFEPA
	Ni4	G50B		Moddervlei* within Algulhas-Heuningnes IBA	Valleyhead Seep	Unknown	C	NFEPA
					Depression	Unknown	C	NFEPA
					Seep	Unknown	C	NFEPA
	Nvii15	G50C		Algulhas# wetlands within Algulhas-Heuningnes IBA	Depression	Unknown	C	NFEPA
	Nv24	G50E		Within Overberg Wheatbelt IBA	Seep	Unknown	C	NFEPA
	Nii5	G50C		Algulhas# wetlands within Algulhas-Heuningnes IBA	Valleyhead Seep	Unknown	C	NFEPA