water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

INKOMATI NWRCS

CONSEQUENCES OF SCENARIOS & RECOMMEND MANAGEMENT CLASSES: SABIE (X_3) RIVER

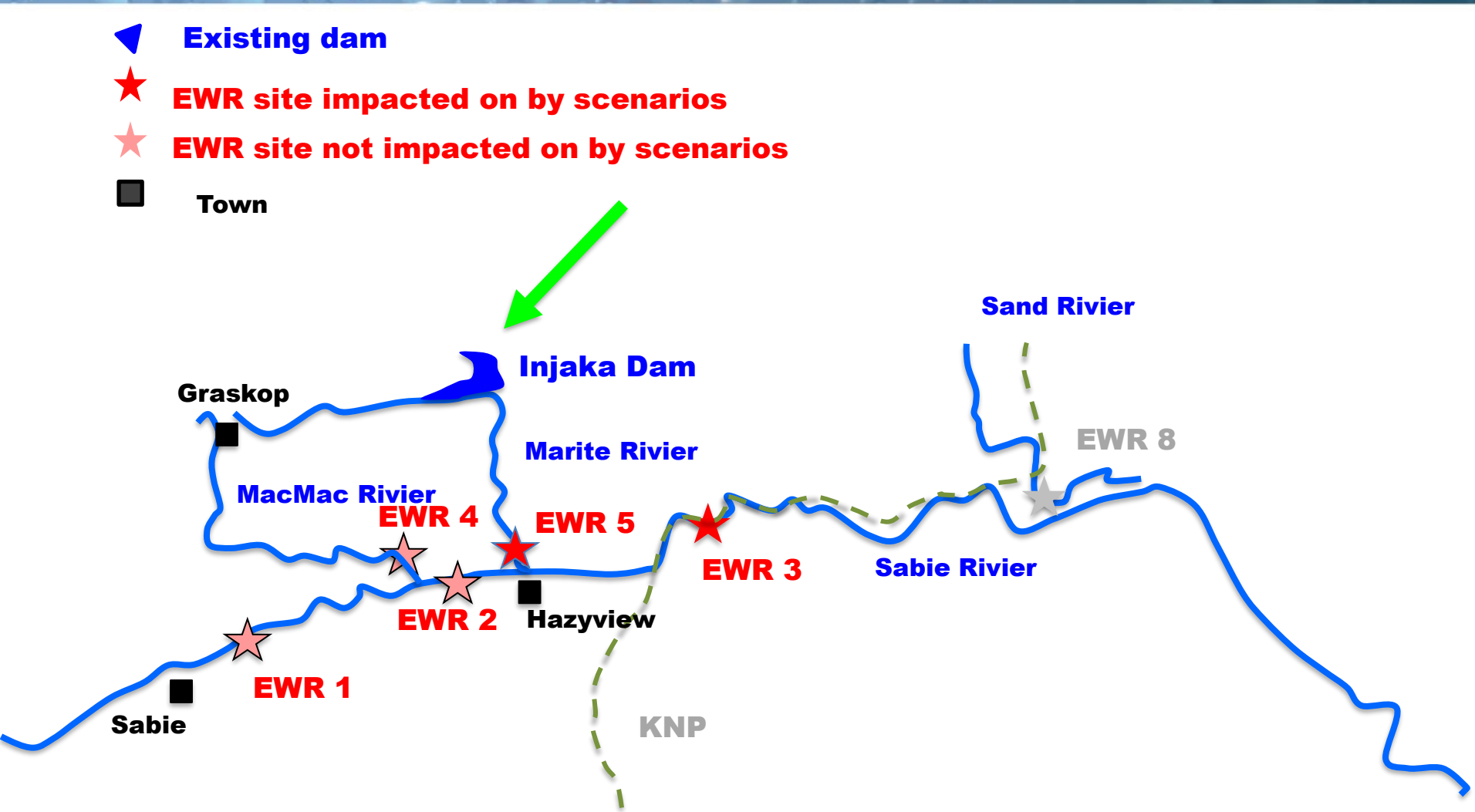
- Ecology
- Water quality
- Ecosystem Services
- Economics
- Management classes

24 November 2014

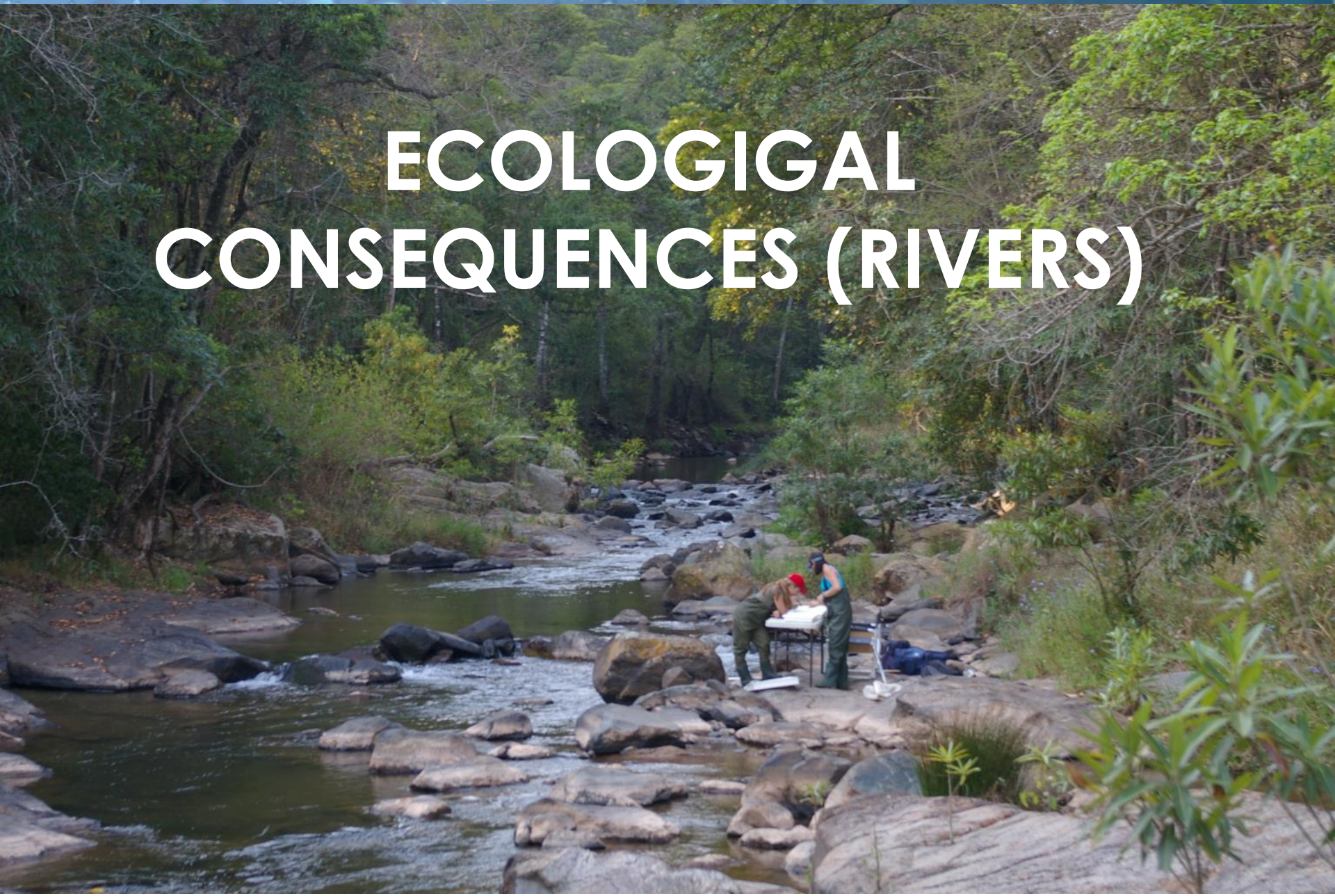
SABIE RIVER (X3) RESULTS

SCENARIOS ONLY IMPACT ON SITES DOWNSTREAM OF INJAKA DAM, I.E.:

- EWR S3 (DS of Marite confluence and US of Sand confluence)
- EWR S54 (Marite River DS of Injaka Dam)


Existing dam
EWR site impacted on by scenarios
EWR site not impacted on by scenarios
Town
Injaka Dam
Graskop
Marite Rivier
MacMac Rivier
EWR 4
EWR 5
EWR 3
EWR 2
Hazyview
EWR 1
Sabie
KNP
Sand Rivier
EWR 8
Sabie Rivier

ECOLOGIGAL CONSEQUENCES (RIVERS)

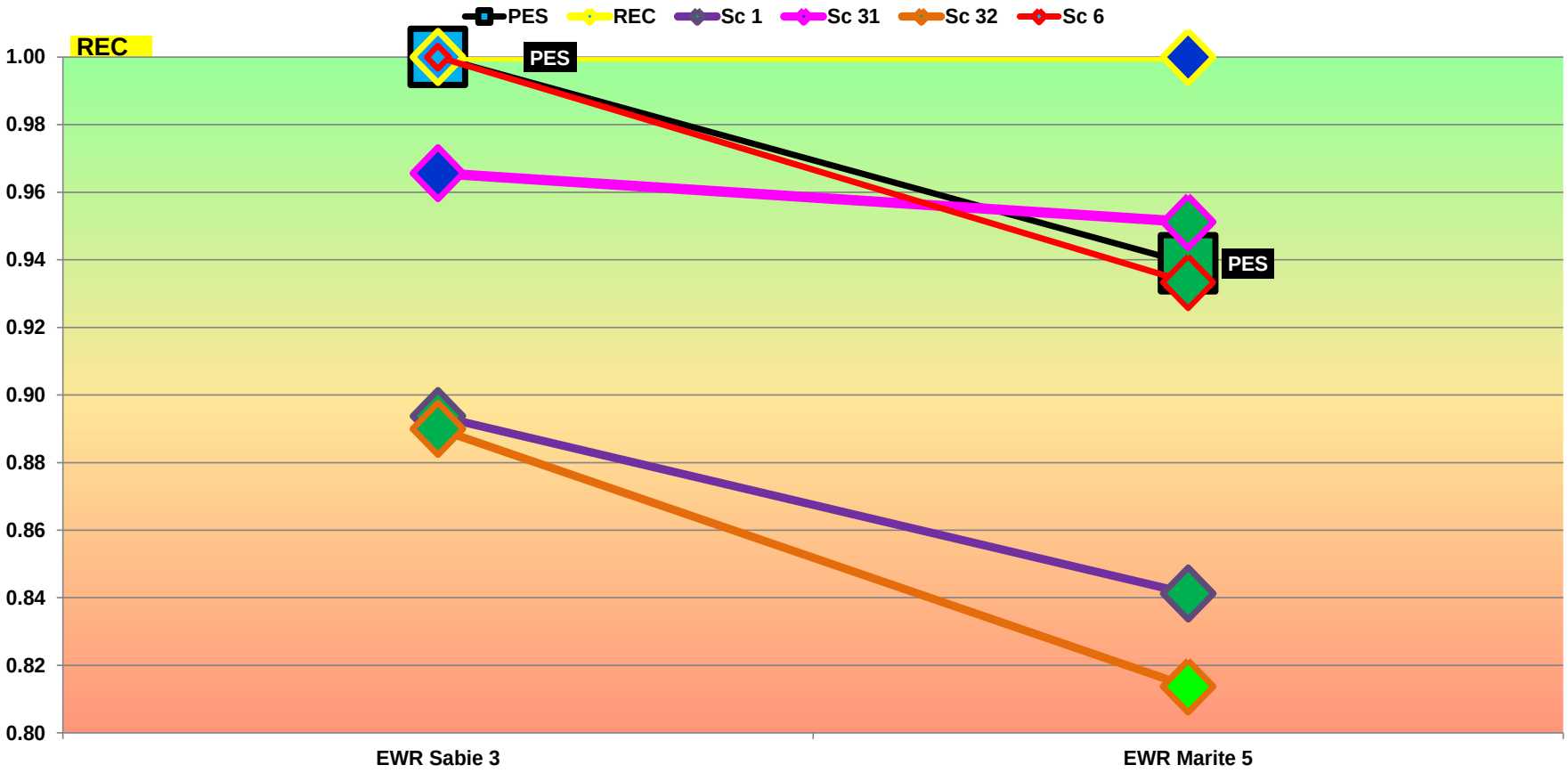


EWR S3: Scenario ranking

Component	PES & REC	Sc 1	Sc 31	Sc 32	Sc 6
Physico chemical	B	C	B	C	B
Geomorphology	B	B	B	B	B
Fish	B	C	B/C	C	B
Invertebrates	B	C	B	C	B
Riparian vegetation	A/B	B	B	B	A/B
EcoStatus	A/B	B/C	B	B/C	A/B

- Increased stress during dry season – water quality and instream biota degradation.
- Reduced base flows impact on marginal veg zone.

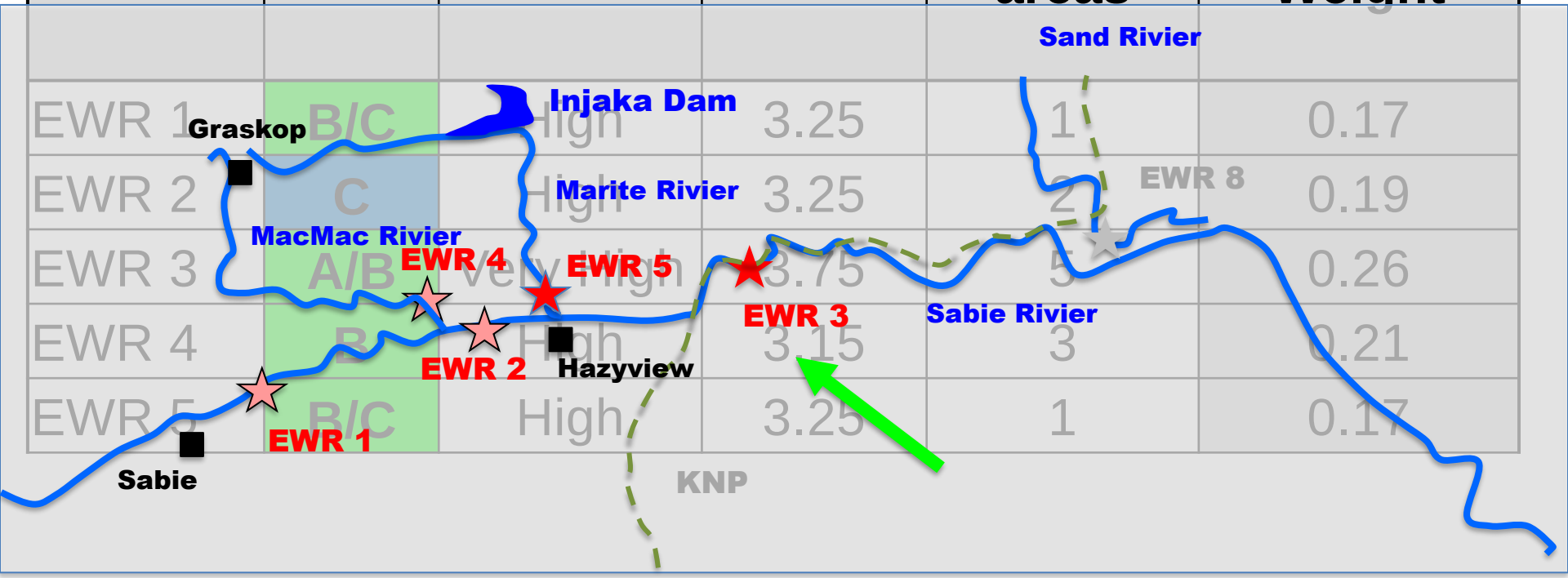
SABIE RIVER: INTEGRATED CONSEQUENCES



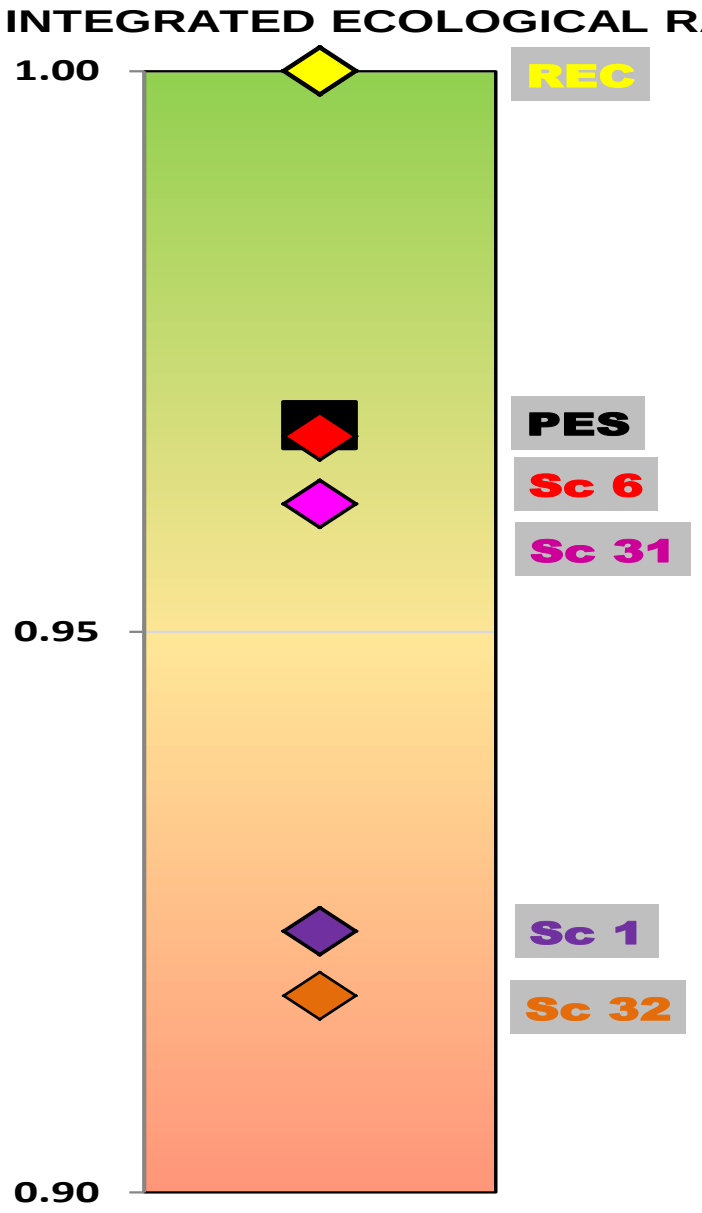
Where lines cross, the ranking order is different between EWR sites. Weights are therefore necessary as most important site ranking must play bigger role than ranking at other sites.

SABIE RIVER: SITE WEIGHTING

EWR site	PES	EIS	Conf	Locality in protected areas	Normalised Weight
EWR 1	B/C	High	3.25	1	0.17
EWR 2	C	High	3.25	2	0.19
EWR 3	A/B	Very High	3.75	5	0.26
EWR 4	B	High	3.15	3	0.21
EWR 5	B/C	High	3.25	1	0.17



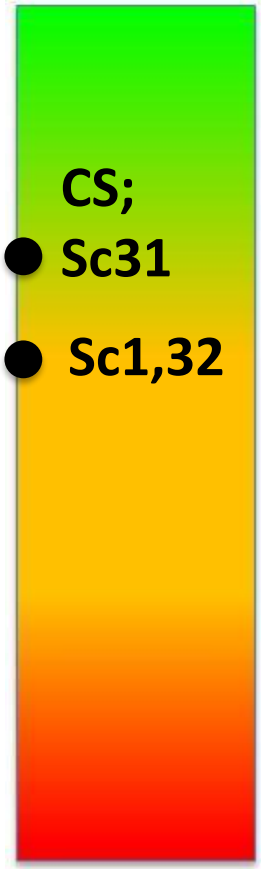
SABIE RIVER: INTEGRATED RANKING



- Sc 31 & Sc 6 best options.
- Sabie flagship river in country and for KNP therefore
- ranking order of Sabie river must override integrated ranking
- Sc 6 only option that maintains PES & REC in Sabie – ecological recommendation.

USER WATER QUALITY CONSEQUENCES (RIVERS)

SABIE-SAND SYSTEM



Site location
MRU Sabie B, incl
EWR 3 on the Sabie River

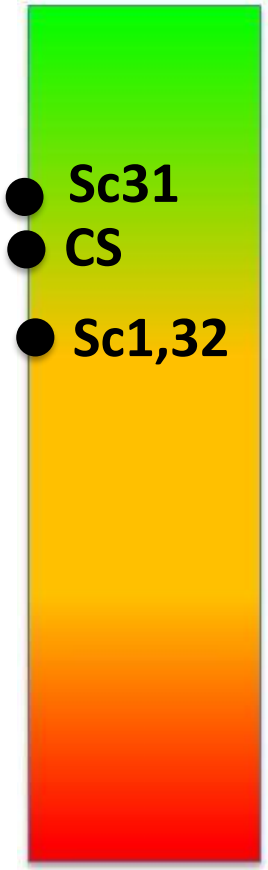
Primary role players
Urban areas + rural settlements, irrigation return flows, Pabeni quarry

Primary wq drivers
Nutrients, salts, toxics, *E. coli* / coliforms, turbidity

Site location
MRU Marite A, incl
EWR 5 on the
Marite River

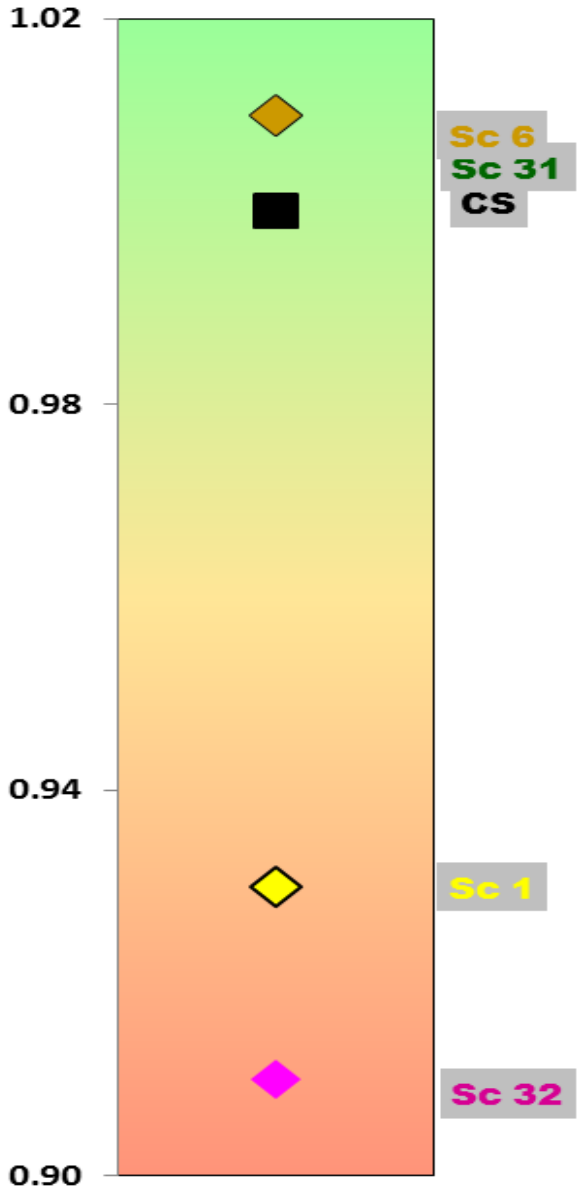
Primary role players
Settlements, irrigation return flows

Primary wq drivers
Nutrients, salts, toxics,



ECOSYSTEM SERVICES CONSEQUENCES

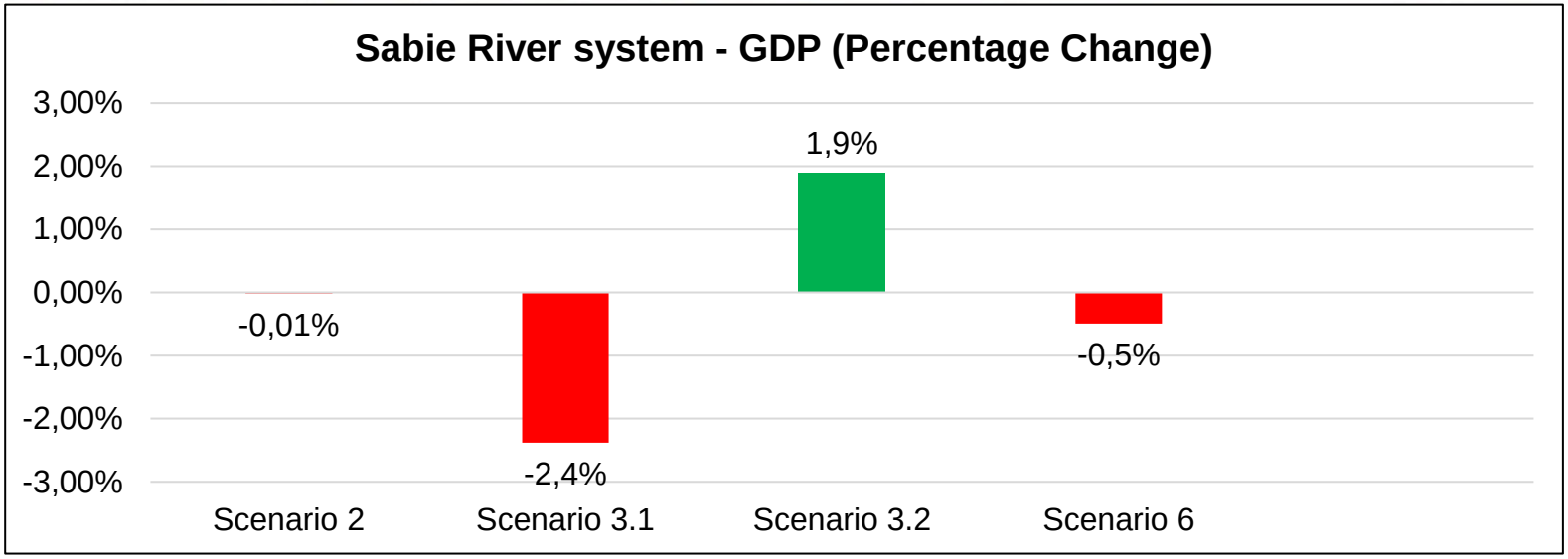
CONSEQUENCES - Sabie

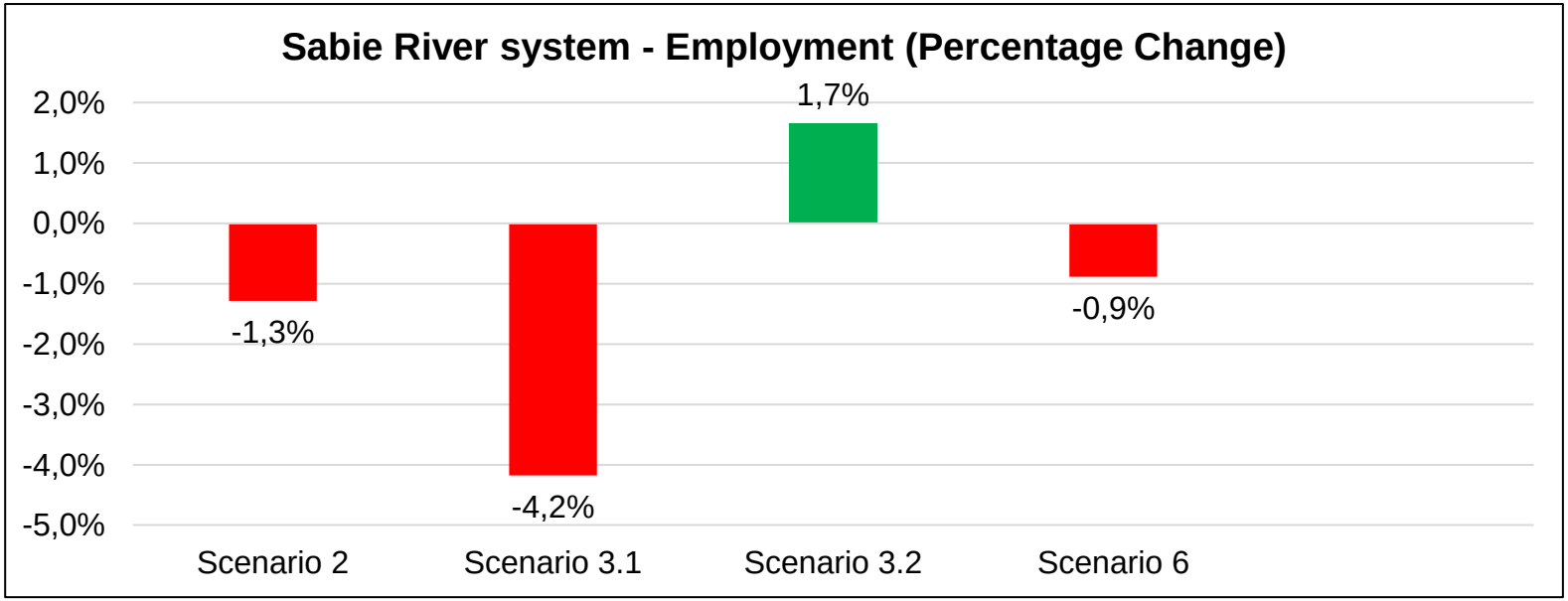


- For the Sabie River system Sc 1, 4 and 32 were deemed to be largely negative with respect to impact on Ecosystems Services.
- Fish" Decrease in Scenarios 1, 4, 32.
- Riparian veg: Some decrease in abundance in reeds, sedges etc. in some scenarios,.
- WQ: Scenarios 1, 4, 32 impact negatively on water quality.
- Geomorph: Some negative impacts in terms of system stability under Scenarios 1, 4, 32.

ECONOMIC CONSEQUENCES

Scenario Evaluation – Sabie River System





RECOMMENDED SCENARIO AND DRAFT MC

Variable Scores & Weights

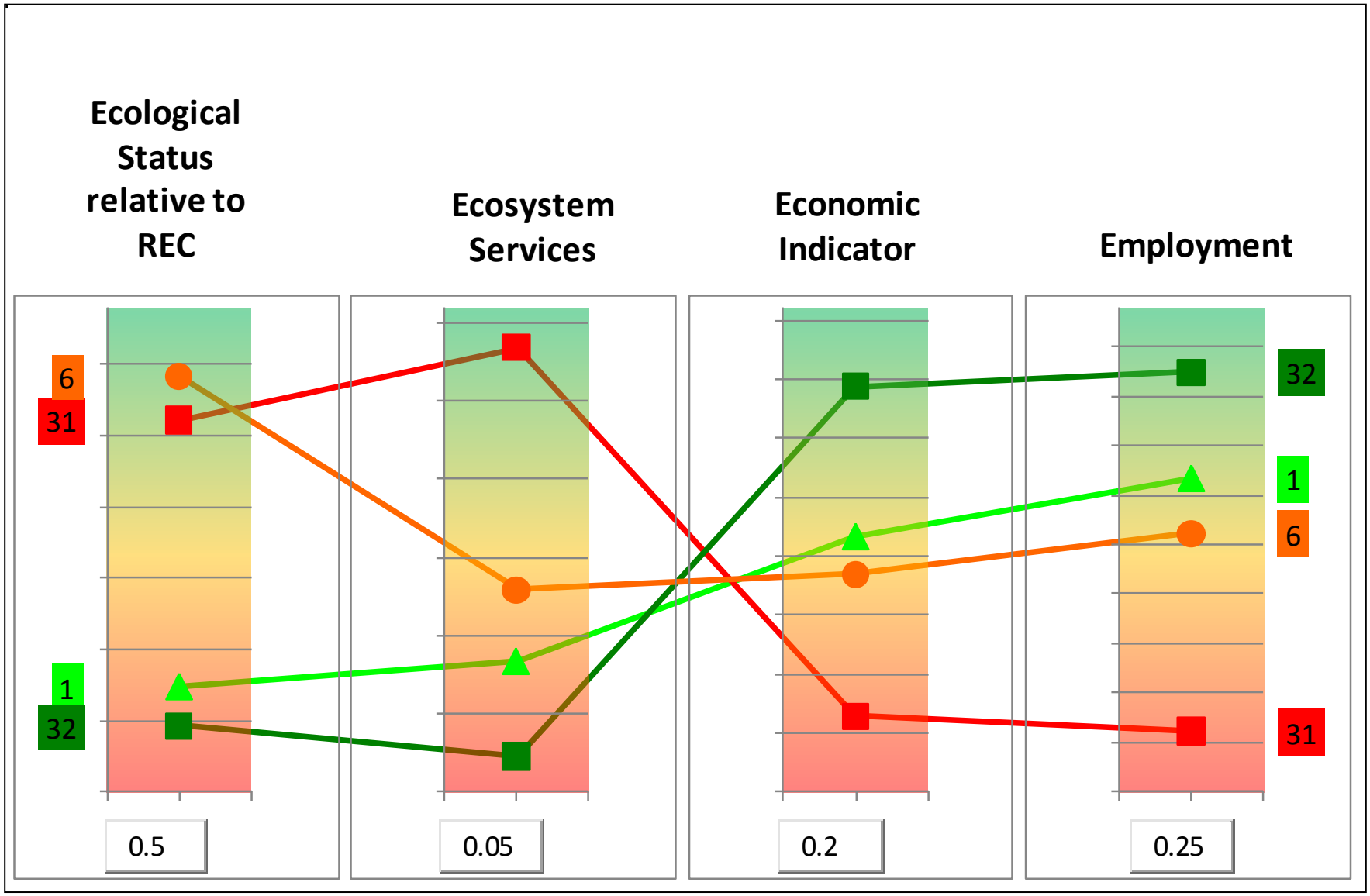
Variables	Scenarios			
	1	31	32	6
Ecological Status	0.92	0.96	0.92	0.97
Ecosystem Services	0.93	1.01	0.91	0.95
Economic Indicator (GDP) (R Millions)	1313.6	1283.1	1339.1	1307.2
Employment	12762	12250	12976	12650

Variables	Weights
Ecological Status	0.5
Ecosystem Services	0.05
Economic Indicator	0.2
Employment	0.25

50% Ecology

50% Socio-Economic

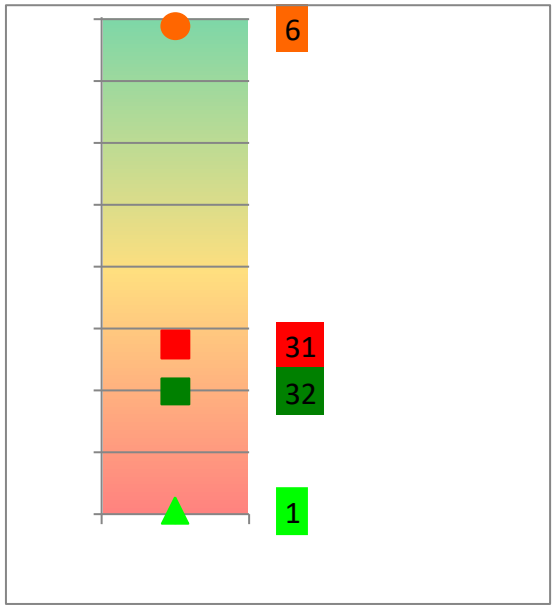
Visualisation of Variables Scores



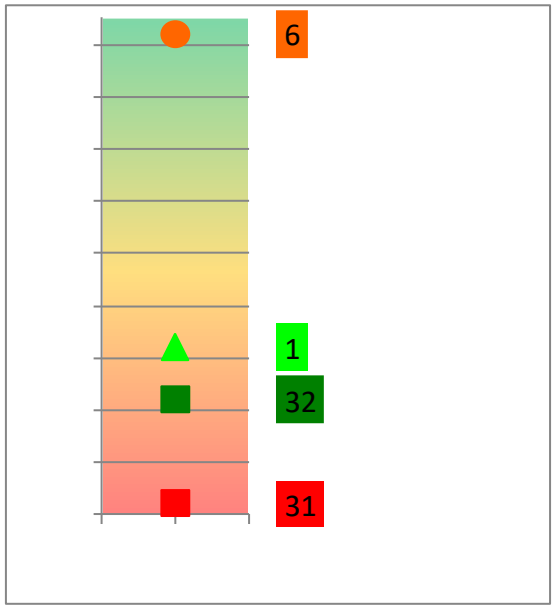
Overall Ranking (Two Rank Methods)

Method	Scenarios			
	1	31	32	6
Overall Score (Rank Order method)	2.45	2.15	2.35	3.05
Rank (1 = best, 4 = worse)	**2**	**4**	**3**	**1**
Overall Score (Normalisation Method)	0.354	0.488	0.450	0.744
Rank (1 = best, 4 = worse)	**4**	**2**	**3**	**1**

Overall Ranking (Normalised Scores)



Overall Ranking (Rank Order)



Sensitivity analysis and synthesis of results

Weights					Rank Position of Scenario (Normalisation Ranking Method)			
Alternative	Ecology	EcoSystem Services	GDP	Jobs	**1**	**31**	**32**	**6**
1	0.50	0.05	0.20	0.25	4.0	2.0	3.0	1.0
2	0.50	0.10	0.20	0.20	4.0	2.0	3.0	1.0
3	0.50	0.15	0.15	0.20	4.0	2.0	3.0	1.0
4	0.50	0.05	0.15	0.30	4.0	2.0	3.0	1.0
5	0.50	0.05	0.30	0.15	4.0	2.0	3.0	1.0
6	0.25	0.25	0.25	0.25	4.0	3.0	2.0	1.0
7	0.20	0.10	0.40	0.30	3.0	4.0	1.0	2.0
8	0.15	0.10	0.45	0.30	3.0	4.0	1.0	2.0

Rank: 1 = best, 4 = worse.

Considerations for scenario selection

- Scenarios 31 and 32 are “extreme” cases; either the ecological protection or the socio-economic is respectively the best or worst.
- Scenario 6 was formulated as a “compromise” providing for growth in water needs from the Sand River System in order to improve the ecological conditions of Scenario 32 towards achieving the REC.
- Scenario 6 imply that water for growth is sourced from the proposed New Forest Dam (Sand River).
- **Scenario 6 is proposed as the preferred choice to achieve a balance between ecological protection and use for the Sabie River System .**

Derivation of the Water Resource Class for each IUA

Recommended Management Class Criteria Table

		% EC representation at units represented by biophysical nodes in an IUA					Prominent Ecological Categories
		≥ A/B	≥ B	≥C	≥ D	< D	
Class I		0	60	80	95	5	A & B
Class II			0	70	90	10	C
Class III	Either			0	80	20	D
	Or				100		

Unit Percentages:

Length of river in a given Ecological Category divided by the total river length in an IUA .

Resulting IUA Management Classes for all scenarios

Integrated Unit of Analysis	Scenarios and Management Class					
	PES	REC	1	31	32	6
X3-1	II	I	I	I	I	I
X3-2	II	I	I	I	I	I
X3-3	I	I	II	I	II	I
X3-4	III	III	III	III	III	III
X3-5	I	I	II	I	II	I
X3-6	I	I	I	I	I	I

Implications of proposing Sc 6 & Sc 72

a. Ecology achieves REC in the Sabie.

b. New Forest Dam to provide growth and release water to supply REC at EWR sites 6 and 8.

c. Waste Water Treatment Works need to be implemented.

d. These scenarios aims to, protect the Sabie and offset the implications of the New Forest Dam with base flow from wastewater discharges.

e. Items b and c will take time – the Sabie's ecology will be below the selected protection for 5 to 10 years.

f. Fall back option; develop groundwater to support growth.

SABIE SCENARIO MATRIX

Scenario	Update water demands	Growth in water demands	EWR
S1	Yes	No	No
S2	Yes	No	Yes (REC)
S31	Yes	Yes	Yes (REC)
S32	Yes	Yes	No
S6	Yes	Minimised to meet REC	Yes (REC)