

1 IFR PROCEDURES 3:

MONITORING PROGRAMME

1.1 BACKGROUND

Monitoring is the periodic measurement and re-measurement of appropriate parameters to determine the effects of particular management strategies or policies, and the response of systems to changes in the wider environment. Monitoring rivers below LHWP dams which are subject to modified flow regimes, is an essential part of IFR management.

This section states the objectives of monitoring, describes the parameters to be monitored or measured; lays down the programme for monitoring; indicates the process of reporting on monitoring results and of management's responses to those results. The technical protocols for monitoring are laid out in Appendix 3.1.

1.2 GOALS AND OBJECTIVES

The goals of instream flow requirements (IFR) monitoring are:

- To assess the efficacy of the recommended instream flow requirements (IFR) allocated for the lower Senqunyane, lower Malibamats' o, lower Matsoku and Senqu rivers.
- To verify that compensation to affected communities is being effective.

The objectives of monitoring are:

- To establish whether or not the agreed IFR flows are being released;
- To determine whether the objectives linked to different components of the flow regime are being achieved, eg., if small floods are maintaining wetbank vegetation;
- To verify that the overall environmental objective, that is, targeted river condition, is being achieved;
- To augment river condition data with incidental information that would assist with recognising potential problems in the study rivers;
- To assess the standard of living of the population at risk such that changes in livelihoods and welfare due to the project can be detected;
- To use this information to guide management interventions as necessary

1.3 PHASING AND MANAGEMENT

Monitoring was planned to take place in two phases:

- Interim monitoring, which would focus on the period from the submission of the IFR study report to LHDA until the IFR policy and long term monitoring plan have been approved: monthly monitoring of water quality has continued and an episode of riparian vegetation monitoring was undertaken over the summer of 2001/02.
- Long term monitoring (over the Project lifetime), which would be guided by the approved IFR policy, for which this document lays out the procedures.

The coordination of the programme is to be done through ESSG. The Operations Planning Branch will participate in the monitoring of water quality, hydrology, hydraulics, aquatic macro-invertebrates and sedimentology.

1.4 MONITORING SITES

1.4.1 IFR biophysical monitoring sites

Given the geographic extent of predicted impacts, the Project's commitments regarding compensation, and the degree of uncertainty associated with the predictions, monitoring will be comprehensive, that is, it will include sites on the Senqu River at which changes may or may not be detectable. Sites marked with an asterisk are Key Sites.

- IFR Site 1* Matsoku near Seshote
- IFR Site 2* Malibamats'o 3 km downstream from Katse road bridge
- IFR Site 3* Malibamats'o at Paray
- IFR Site 4 Senqu at Sehong-hong
- IFR Site 5 Senqu at Whitehills
- IFR Site 6 Senqu at Seaka
- IFR Site 7* Senqunyane at Marakabei
- IFR Site 8* Senqunyane upstream of the Senqu confluence.

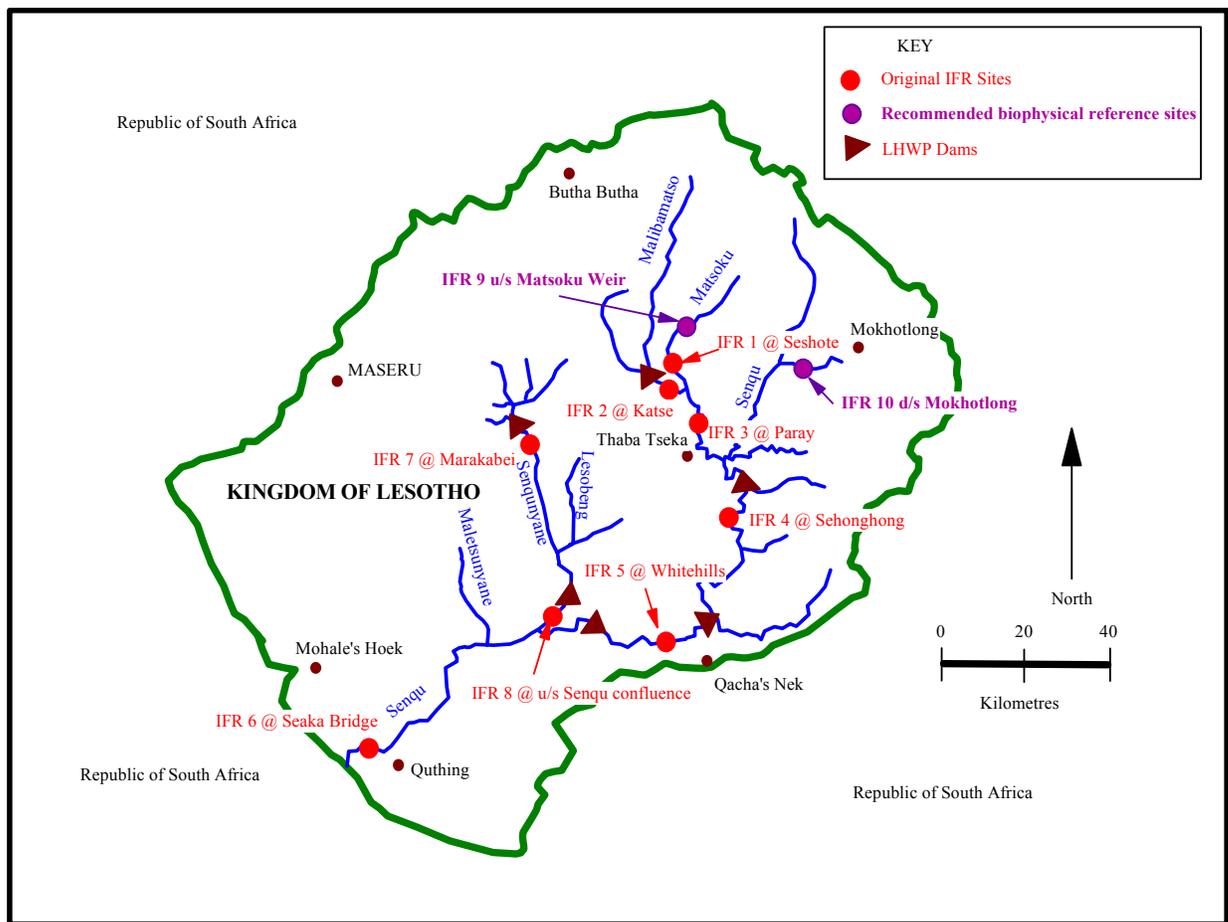


Figure 3.1: Location of the original IFR sites and reference sites included in the monitoring programme

1.4.2 Reference sites

Understanding the natural fluctuations within any ecosystem is essential to successful monitoring. The monitoring programme should be able to distinguish between natural and man-made, flow-related or flow-unrelated change. However, distinguishing long-term trends from inter-annual variability requires years of study. In the case of the Lesotho rivers, the range of natural temporal and spatial variability is not well known, so monitoring will have to contribute to this knowledge rather than draw from it.

Reference sites are sites similar to IFR sites, but are located outside the expected area of disturbance. These sites will provide information on natural variability, because they are not subject to Project induced reductions in flow. Reference sites are located at:

IFR Site 9: Matsoku River upstream of the headwaters of Matsoku Weir – reference for IFR Site 1.

IFR Site 10: Senqu River downstream of Mokhotlong – reference for IFR Sites 2, 3 and 7.

1.4.3 IFR Socio-economic monitoring areas

The monitoring protocol for measuring and evaluating socio-economic status in the process of being revised and refined and will be completed in time for implementation as of January 2004.

1.5 BIOPHYSICAL MONITORING PROGRAMME

1.5.1 Summary of biophysical programme

A summary of the IFR monitoring programme is provided in Table 3.1.

Table 3.1 : Summary of biophysical data collection activities for monitoring river condition.

Component	Tasks	Where data should be collected	Frequency of collection
Hydrology	Continuous time series stage height data	IFR Site 1, 2, 3, 4, 5, and 7 and outlets of Katse, Mohale and Matsoku structures	Continuous.
Habitat	Habitat mapping and characterisation	IFR Site 1, 2, 3, 4, 5, 6, 7 and 8. Reference IFR 9 and 10.	Every two years.
	Re-survey of cross-sections		Every two years.
	IHAS		Twice per year
Water quality	Routine monthly sampling of nutrients	IFR Site 1, 2, 3, 4, 5, 6,7 and 8. Reference IFR 9 and 10.	Monthly.
	WQ and temperature monitoring - using loggers	IFR Site 1, 2, 3, and 7	Continuous
	- using hand-held field meters	IFR sites 4, 5, 6 and 8; Reference sites 9 and 10	Monthly
	Faecal coliforms	IFR Site 1, 2, 3, 4, 5, 6, 7 and 8.	Monthly
	RBA	IFR Site 1, 2, 3, 4, 5, 6,7 and 8. Reference IFR 9 and 10.	Twice per year in spring and autumn
Riparian vegetation	Algae	IFR Site 1, 2, 3, 4, 5, 6,7 and 8. Reference IFR 9 and 10.	Monthly
	Zonation	IFR Site 1, 2, 3, 4, 5, 6,7 and 8. Reference IFR 9 and 10.	Once per annum in early autumn
	Braun-Blanquet		
Macro-invertebrates	RBA	<i>See Water Quality</i>	
	Visual assessments for simuliids and snails	At all IFR sites and IFR Reference sites 9 and 10.	Twice per year in spring and autumn
Fish	Routine fish surveys.	IFR Site 1, 2, 3, 4, 6, 7 and 8. Reference IFR 9 and 10.	Twice per annum (summer and winter).

Table 3.2 : Summary of frequency and timing of the monitoring activities

Discipline	Data	Timing and frequency of monitoring activities											
		J	F	M	A	M	J	J	A	S	O	N	D
Habitat (Geomorphology/ Hydraulics)	Diversity of physical habitat					X							
	Pool depth and area					X							
	IHAS					X				X			
Hydrology	Dam release schedules and flow records at monitoring sites	Continuous (3-hourly)											
Water quality	Temperature, pH and electrical conductivity	Continuous (3-hourly)											
	Nutrients	X	X	X	X	X	X	X	X	X	X	X	X
	RBA				X					X			
	Faecal coliforms and <i>E. coli</i>	X	X	X	X	X	X	X	X	X	X	X	X
Aquatic vegetation	'Red-flag' indicators: • Algae	X	X	X	X	X	X	X	X	X	X	X	
Riparian vegetation	Species composition, distribution, abundance				X								
Macroinvertebrates	RBAs (see water quality)				X					X			
	'Red-flag' indicators: Snails and Simuliids				X					X			
Fish	Composition, relative abundance and recruitment	X						X					

Detailed protocols for the monitoring of the parameters indicated in the programme above are laid out in Appendix 3.1 (end of Procedures 3 section).