Appendix 2

The appendix includes:

1. Table summarizing the different choices made for each step in the lake problem (Table A2.1)
2. Table listing the various objectives analyzed before arriving at the five objective problem formulation (Table A2.2)

Table A2.1 Comparing various approaches towards managing a threshold-based ecosystem

SNo.	Steps in Figure 2	Choice(s) made for the lake problem
1.	Elicit system model, decisions, uncertainties, objectives, and constraints	Model: Lake model by Carpenter et al. (1999) Decision: time series of anthropogenic phosphorus input to the lake Uncertainties: standard (10000 SOWs) and deep (90000 SOWs) uncertainty Objectives: five objectives described in Appendix 3 Constraints: single constraint on reliability
2.	Test alternative problem formulations	Three alternative problem formulations selected for testing
3.	Identify tradeoffs under well characterized uncertainty	Tradeoffs identified by using the BORG MOEA described in Appendix 1
4.	Define robustness based on stakeholders' performance requirements	Definition adapted to satisfy multiple performance requirements under two assumptions definitions of uncertainty (Appendix 3)

Table A2.2 Various objectives analyzed before arriving at the five-objective formulation

SNo.	Objective	Rationale for including/excluding	References/ motivations
1.	Bentham's formulation of utility (expectation based approach)	Used in most analysis of the lake problem in literature	Carpenter et al. (1999), Brozovic and Schlenker (2011)
2.	Rawl's formulation of utility (max-min approach)	An alternative definition of utility used in some studies, removed due to mathematical challenges in optimizing this objective as it tends to solely focus on the worst case causing it to depend upon the chosen uncertainty representation	Rawls (1971), Tol (2000)
3.	Discounted financial benefits	An attempt to break up the utility function into its components, later discarded as: a. discounted losses are heavily correlated with objective (7), b. the standard MEU approach is lost	
4.	Discounted losses		
5.	Undiscounted expected utility of present stakeholders	Represent stakeholders separated in time without any discounting	Brundtland and Development (1987), Holling (1973)
6.	Undiscounted expected utility of future stakeholder		
7.	Average levels of phosphorus in the lake	Represents the preference to solely focus on the ecosystem under analysis	Admiraal et al. (2013)
8.	Reliability	Represents the preference to prevent irreversible changes in multistate ecosystems	Bennett et al. (2008), Carpenter and Lathrop (2008)

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