CHAPTER 3

COMPARATIVE ASSESSMENT OF RESERVOIRS WITH NON-RESERVOIR ALTERNATIVES

3.1 INTRODUCTION

Until recently, the objectives in planning and management have typically embraced some or all of the following issues: economic development, self-sufficiency, equity and environmental quality. Now, the purpose of sustainable development has emerged which may embrace elements of the above objectives. There are a number of purposes related to these objectives for which a storage reservoir can be built, such as fulfilling the needs of society regarding water supply, energy, transport and protection from floods. However, there are also other, non-reservoir, ways to attain these aims. Usually, there exist a spectrum of means to achieve a target, with differing values of quality criteria such as cost, time, reliability, by-products, etc. A multidisciplinary consideration is therefore needed where alternative options are identified, including non-structural solutions and several variants of structural measures. Each alternative may have its advantages and disadvantages. One has to evaluate all the alternative solutions, both structural and non-structural, weighting their pros and cons in an objective way.

The basic questions which come immediately to mind when studying alternatives follow the general systems approach where three elements are identified: objective to be reached, quality criteria and constraints:

- Is the objective of concern attainable by the means considered under the constraints assumed?
- What are the possible alternatives?
- What are the values of a vector of quality indices describing various alternatives in a comprehensive way?

The constraints in question may pertain to such aspects as permissible environmental impact, funding, social acceptance and political effects.

Examples of quality indices which could be used when comparing alternatives may relate to such matters as socio-economic and financial feasibility, related investment and operational costs; intervention in the natural regime, stress to ecosystems and humans, use of energy and raw materials, characteristics of waste and pollution problems and safety, risk and reliability issues. It is also necessary to examine the opportunities for reversibility

(flexibility) and rehabilitation. Can the original "unengineered" state be reconstructed at all, and if so, then at what cost?

When comparing alternatives a comprehensive holistic perspective is necessary, where not only short-term benefits but also long-terms impacts and side effects are thoroughly evaluated. The time horizon of concern may extend to the design lifetime of a reservoir and beyond. Although, typically, it is not environmental objectives that play the principal role in taking decisions on creating a reservoir, these issues can be accommodated as either quality indices or constraints and are discussed in Section 2.1.3. Conservation objectives need to be taken into account, such as conservation of nature and resources (both renewable, which should be utilized up to their sustainable yield, and non-renewable, where recycling should be considered, and transition to renewable resources). Protection of natural and cultural heritage needs to be secured. Limits to the load which the environment can absorb without adverse consequences should be determined. The viable alternatives should be revealed, made transparent to the public, subject to public discussion and, finally, the decision as to how to solve the problem should be accepted by society.

It would be instructive to elaborate on a number of case studies, where the criterion indices of existing alternatives may be evaluated in a straightforward way. One could build a matrix of different objectives and criteria, identifying less sustainable and more sustainable examples of reservoirs and comparing them with non-reservoir alternatives.

As an alternative to development projects to meet foreseen higher demands for energy or resources, such as water, it is necessary to consider also the possibilities of demand management. In the past, the focus has been on the supply side, developing new sources of water to meet a higher demand. Now, a change of this approach must be promoted, i.e. a focus on the demand side where demand management would provoke improved efficiency of water use.

3.2 MULTIPURPOSE RESERVOIRS VERSUS ALTERNATIVES

In the present study, some alternative means of achieving different purposes such as, for instance, water supply, energy generation and flood control will be compared. There exists, however, an intrinsic difficulty in comparing multi-purpose reservoirs that serve various, often conflicting, objectives and non-reservoir alternatives. Power generation is the only objective of a thermal power station, while a reservoir may have many purposes in addition to hydropower generation, such as flood control, water supply, navigation, recreation, water quality, wetlands, water habitat and scenic beauty. Meeting all the different multipurpose uses of a reservoir would require a number of separate non-reservoir projects for energy, water supply, flood protection and transport,