2.0 ANALYTICAL APPROACH

2.1 DEVELOPMENT OF THE LOWER MOKELUMNE RIVER MANAGEMENT PLAN

BioSystems reviewed the scientific literature, interviewed key specialists with knowledge of the river system, and conducted extensive field work and computer model simulations studies. This information, in conjunction with consultations within the BioSystems' fisheries team and with EBMUD and other agencies, was used to develop the LMRMP. The goal was to develop an approach for managing the river and the upstream reservoirs to balance the documented needs of the river fishery with those of EBMUD's water supply, reservoir fisheries, and recreation visitor use. The elements of the analytical approach used to determine management strategies were to:

- Segment the river into reaches for analytical purposes.
- Define the key issues and challenges.
- Describe the results of field research, statistical analysis, and computer simulation studies.
- Specify and evaluate alternative management goals and strategies.
- Develop preferred management goals and strategy.
- Identify monitoring criteria and need for further information.

2.2 ANALYTICAL REACHES

The Lower Mokelumne River can be subdivided into reaches characterized by unique hydrology, fish habitats, and water supply developments. These reaches differ in their importance to fish species as well as management needs and potential. After reviewing the hydrologic database, fish species assemblages, topography, land use, and historical development of the Lower Mokelumne River basin, the lower section of the river was partitioned into four reaches for planning and modeling (Figure 2-1): Reach 1, the uppermost section, is Camanche Reservoir; Reach 2, Camanche reach, extends from the tailwaters of Camanche Reservoir to Woodbridge Dam (Lake Lodi is a subunit of reach 2); Reach 3, Woodbridge reach, extends from Woodbridge Dam to the confluence of the Cosumnes River; Reach 4, the Delta, extends from the Cosumnes River to the Carquinez Strait, west of Suisun Bay. Dividing Reaches 3 and 4 at the Cosumnes River is somewhat arbitrary. It could also be split at Ray Road (beginning of tidal influence) or below the Delta Cross Channel where Mokelumne hydrology is diminished by flows from the Sacramento River. Management of Reaches 1-3 was incorporated directly into the management plan. Although management of Reach 4 is largely outside the scope of EBMUD activities, this important reach was examined for impacts from Mokelumne flow management in developing the LMRMP. Conditions in this reach were also evaluated for their impact on Mokelumne River fisheries.

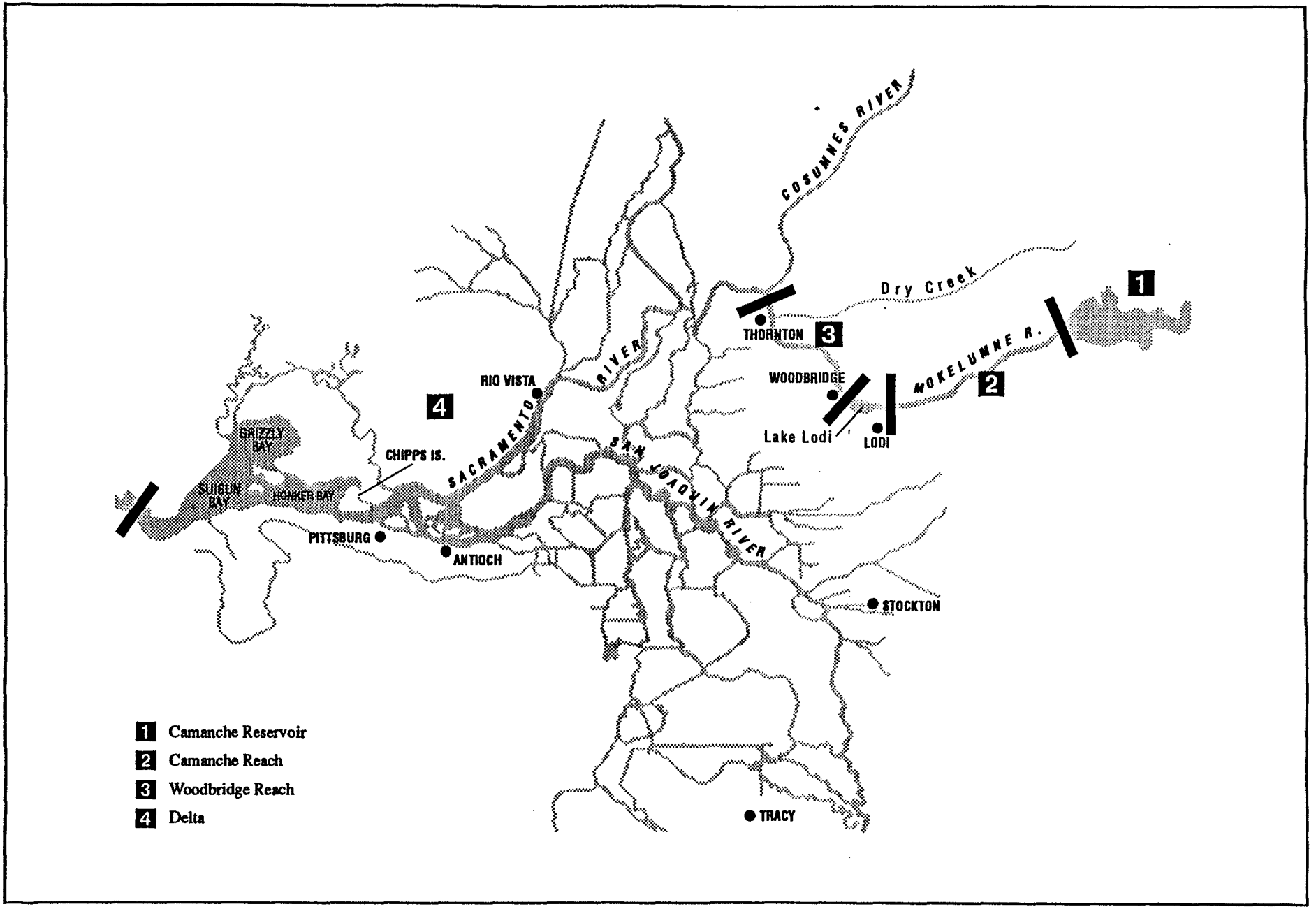

Figure 2-1. Analytical and planning reaches for the Lower Mokelumne River Management Plan.

2.3 ISSUES AND CHALLENGES

Fisheries management issues and challenges vary in each reach, such as whether species are resident or in transit and the presence of water management facilities. Water temperature and other factors contributing to fish mortality or biological success also differ greatly within each reach. These issues are discussed in Section 3.0. The results of recent studies conducted by EBMUD are included in this section.

2.4 GOALS AND ALTERNATIVES

The Lower Mokelumne River is a multiple use resource. Fishery management on the river must conform to a framework of political, economic, and social considerations extending to the Sacramento-San Joaquin delta and ocean fishery, as well as to the river itself and reservoirs above. Traditional fisheries management strategies such as maximum sustainable yield (MSY), economic sustainable yield (ESY), and even optimum sustainable yield (OSY) are not solely appropriate because fisheries are not the only use of the river. In practice, goals are developed by a process of questioning and justifying desired fish stocks and water deliveries while considering institutional factors such as CDFG codes and EBMUD board policy guidelines. Section 4.0 presents a description and evaluation of several management strategies for the river, including two base cases and the CDFG management plan (CDFG 1992).

2.5 PREFERRED MANAGEMENT GOALS AND STRATEGY

Discrete goals can be assessed in terms of legislative, administrative, socio-cultural, economic, and scientific references. Goals are evaluated using a screening process that keeps decision-making as objective and conflict free as possible. Because of the complex interaction of the many factors relating to flows, reservoir management options, water temperature, and fisheries, the screening process depends heavily on computer-based simulation models and statistical analyses. Section 5.0 provides details of the preferred LMRMP selected through this process.

2.6 MONITORING AND RESEARCH

Fisheries management is usually practiced in a changing environment (political, physical, and biological) with incomplete information; fisheries management in the Lower Mokelumne River is no exception. Several factors are likely to alter the current Mokelumne River fishery management framework including new and future endangered species listings, the North Delta and South Delta Plan, and changing Bay/Delta water quality and quantity standards and discharge requirements, and pumping rates for the SWP and CVP.

The importance of firm water allocations to ensure water is delivered to the EBMUD service area is understood. However, incomplete scientific information on the Mokelumne River fishery leads to uncertainty and concern over precise allocation of water over a set number of

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years. Continued monitoring and frequent consultation are necessary aspects of a successful LMRMP. In contrast to the value of firm water allocations, fisheries management should be a dynamic process. For example, the North Pacific Fisheries Management Council in Alaska and the Pacific Fisheries Management Council in Portland meet at least four times a year to make proposals, hold public and scientific meetings, take administrative actions, or set rules that eventually become new catch and effort regulations in the different states. Recent management council sessions have dealt with issues as diverse as ballot initiatives (Propositions 321) that regulate fishing gear, court injunctions enjoining enforcement regulations, limited entry for several species, endangered species issues, maximum allowable catch, revised stock assessments, and evaluation of the effects of past management efforts (PFMC 1991).

In the long term, a management strategy that incorporates flexibility and change will be more responsible, cost effective, and biologically defensible than conventional confrontational strategies which result in inflexible rules. Almost every small river and coastal stream in California has a "support" group seeking to rehabilitate salmonid runs. The aspirations of these groups often conflict with farmers, developers, water and power utilities, and local property owners. Conflicts are expected to escalate as the number of these groups grows and as more restrictive legislation is adopted. Given the increasing stream rehabilitation constituency, legislative and judicial uncertainties, and the uncertainty inherent in predicting fisheries responses to habitat and environmental changes, a flexible management approach is believed to be the best management practice to realize the least public acrimony and legal resistance, and the best approach to increasing target species productivity.

Management goals and strategies, for example, can be based on easily documented indicators. The goals are structured around such objective quantities as the amount of habitat needed to achieve fishery or water quality objectives. These goals and strategies become target elements of a fisheries management plan.

As habitat improves, water quality and fish populations must be monitored to document the response of target species to the habitat changes made. Statistical evaluation procedures with built-in ranges can validate a decline, no change, or improvement in a particular population.

Plan goals that are not met can be modified or mitigation procedures can be adopted. Social, economic, or legislative imperatives will undoubtedly change over time, and must be addressed by a forum of concerned groups and agencies. Information is critical at this stage and a formal research program should be established to provide as much pertinent information as possible. Relevant data should be collected to identify population trends of target species and life-stages, basic environmental data (i.e., flow, temperature, water quality parameters), and response of target species and life-stages to management actions. A monitoring and research plan is presented in Section 6.0 to monitor the success of the LMRMP and to provide information for future resource management decisions.

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