FOREWORD

This report develops a water balance forecast model for Mono Lake, a terminal lake noteworthy for its biologic and geologic peculiarities. The lake has attracted considerable attention in recent years as diversions of its tributary streams have resulted in lower lake levels and higher salinities. Fundamental to an understanding of the lake's biotic and abiotic systems is a knowledge of the lake's water balance and its response to human-induced and climatic changes in the hydrologic regime. Previous Mono Lake water balances have been methodologically flawed and have not had the accuracy required for the resolution of complex management questions that have arisen as a result of the artificial lowering of the lake.

Although a terminal lake water balance is conceptually simple, its development as a predictive management tool can be quite complicated. Each component of the balance is the result of a complex array of incompletely understood physical processes, the accurate quantification of which is deserving of its own research project. Because of the inherent errors in quantifying components and the difficulty of identifying some of the components, there is a tendency in many water balance models to substitute subjective judgement for rigorous analysis in developing a calibrated model; unknown components and errors are commonly lumped together and quantified as the residual to make a model fit observed data or the boundaries of the model are not specifically delineated. Such models, by their subjectivity, tend to become "black box" models that are hard for independent researchers to reproduce, and are of limited use in predicting lake response outside the range of the calibration data.

The model described in this report follows a rigorous methodology outlined in Chapter I and discussed in detail in Chapter II. The key elements of the methodology are:

1. Establishment of a water balance model boundary
2. Identification of all significant inflow, outflow and storage change components.
3. Independent quantification of each component over a carefully selected base period,
4. Quantification of component and overall water balance error
5. Regression of the overall error against statistically significant components,
6. Verification of model with a different time period than that used in calibration.

The water balance model is used to forecast lake levels and salinities. This is done in Chapter III, for different hydroclimatic and water export assumptions. Although the environmental implications of a given lake level are beyond the scope of this study, the model provides an essential tool for water policy and management decisions in the Mono Basin.

A project as big as this required a lot of assistance. I

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ABBREVIATIONS

AGENCIES

CADPW: California Department of Public Works

CADWR: California Department of Water Resources

CASWRCB: California State Water Resources Control Board

JLPUD: June Lake Public Utilities District

LADWP: Los Angeles Department of Water and Power

WPUD: Lee Vining Public Utilities District

NOAA: National Oceanic and Atmospheric Administration

SCE: Southern California Edison

UC: University of California

USBLM: United States Bureau of Land Management

USFS: United States Forest Service

USGS: United States Geological Survey

WMO: World Meteorological Organization

COMPONENTS

Inflows

DS: Diffuse Seepage

GLP: Grant Lake Reservoir Precipitation

GWR: Groundwater Recharge

HR: Hidden Recharge

ISP: Land Surface Precipitation

NLSP: Net Land Surface Precipitation

MLP: Mono Lake Precipitation

NMI: Net Municipal Inflow

NSP: Non-Sierra Precipitation

NSR: Non-Sierra Runoff

S: Springflow

SNGR: Sierra Nevada Gaged Runoff

SNP: Sierra Nevada Precipitation

USR: Ungaged Sierra Runoff

VCI: Virginia Creek Inflow

Outflows

BGE: Bare Ground Evaporation

GE: Grant Lake Reservoir Evaporation

GWEX: GroundWater Export

ILET: Irrigated Land Evapotranspiration

LSET: Land Surface Evapostranspiration

MLE: Mono Lake Evaporation

NGLE : Net Grant Lake Evaporation

NSET: Non-Sierra Evapotranspiration

PETA: Phreatophyte Evapotranspiration Above 6428 ft

PETB: Phreatophyte Evapotranspiration Below 6428 ft

RET: Riparian Evapostranspiration

SNET: Sierra Nevada Evapotranspiration

SWEX : Surface Water Export

Storage Changes

GTSC: Grant Lake Reservoir Storage Change

GWSC: Groundwater Storage Change

MLSC: Mono Lake Storage Change

SMSC: Soil Moisture Storage Change

UNITS

ac: acre(s)

ac-ft: acre-feet

cfs: cubic feet per second

F: Farenheit

ft: feet

gal: gallons

g/l: grams/liter

in: inches

mi: miles

PPm: parts per million

yr: year

MISCELLANEOUS

avg: average

cr: creek

est: estimate

evap: evaporation

ET: evapotranspiration

FM: flow measurement

MGWB: Mono Groundwater Basin

msmt: measurement

P.: page

PET: potential evapotranspiration

precip: precipitation

Resv: reservoir

SD: standard deviation

SNARL: Sierra Nevada Aquatic Research Laboratory

SPSS: Statistical Package for the Social Sciences

TDS: total dissolved solids