

WATER AND LAND USE

WATER AND LAND USE

PLANNING WISELY FOR CALIFORNIA'S FUTURE

Karen E. Johnson and Jeff Loux

Copyright © 2004

by Karen E. Johnson and Jeff Loux

All rights reserved.

Printed in the United States of America.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopied, recorded, or otherwise, without the prior written approval of the authors and the publisher.

September 2004

Cover painting courtesy

© Wayne Thiebaud/Licensed
by VAGA, New York, N.Y.

“Waterland” by Wayne Thiebaud
1996, oil on canvas, 48" x 60"

Cover and book design
by Solano Press Books

Index by Paul Kish,
Rohnert Park, California

ISBN 0-923956-78-6



Solano Press Books
Post Office Box 773
Point Arena, California 95468

tel (800) 9310-9373
fax (707) 884-4109
email spbooks@solano.com
internet www.solano.com

Chapters at a glance...

- 1 **Water and Land Use
Are Inextricably Linked** *page 1*
- 2 **Legislative, Regulatory,
and Policy Framework
for Water Planning** *page 23*
- 3 **Land Use Planning
and Its Relationships
to Water Resources** *page 53*
- 4 **Analyzing
Water Demands** *page 73*
- 5 **Evaluating
Water Supplies** *page 103*
- 6 **Preparing an Integrated
Water Resources Plan** *page 129*
- 7 **Linking Water Quality
Protection with Land Use** *page 145*
- 8 **Towards Collaborative
Water Planning** *page 175*

Contents

Preface	xv
Acknowledgments	xxi
About the authors	xxiii

CHAPTER 1

Water and Land Use Inextricably Linked / 1

A Brief History of California's Urban Growth and Water Development 1

A Snapshot of Today 1

A Bit of History 4

The Early Years (1769–1900) 4

First Big Projects to Serve
Urban Use (1900–1930) 8

Water and Growth—
Inextricably Linked 8

Era of the Great Projects 9

Environmental Transition (1970–1990) 10

Towards Collaboration and Water
Management (1990–present) 12

Linking Water
Resources and Land Use 14

Why Water Resources and Land Use
Decisions Are Not Always Linked 14

Dedication to Mandates 14

Institutional Confusion 15

Professional Differences 16

Time Horizon, Scale,
and Complexity 17

The Political Variable 18

The Growth Debate 18

Today's Complex Water Planning Environment 19

Towards Integrated Water and Land Use Planning 20

CHAPTER 2

Legislative, Regulatory, and Policy Framework for Water Planning / 23

State Water Planning 24

Water Quality Protection 30

Porter-Cologne

Water Quality Control Act 30

Federal Clean Water Act 31

National Pollutant Discharge
Elimination System 31

Section 401 of the
Clean Water Act 32

Section 303(d) of
the Clean Water Act 33

Urban Water Management Plans 34

Definition and History 34

Process and Contents of an
Urban Water Management Plan 35

State of the Art in Urban
Water Management Plans 37

How to Use Urban
Water Management Plans 38

Water Use Efficiency Legislation 39

Water-Efficient Plumbing 40

Memorandum of Understanding
Regarding Urban Water Conservation 41

Landscape Water Conservation 42

Model Water-Efficient
Landscape Ordinance 42

Landscape Retrofit Ordinances 43

Agricultural Water Use Efficiency 44

Bureau of Reclamation Contracts and the
Central Valley Project Improvement Act 45

Water Recycling 45

Regional Collaborative Solutions 45

Groundwater Management 46

Varied Forms of Local
and Regional Management 46

Groundwater Management Plans 49

CALFED Bay-Delta Program 51

Contents

CHAPTER 3

Land Use Planning and Its Relationships to Water Resources / 53

The General Plan, Specific Plan, and Local Ordinances	54
General Plan	54
Procedural Requirements for Water Resources in the General Plan.	55
Substantive Requirements for Water Resources in the General Plan.	55
Optional Water Element	57
Specific Plans	57
Integrating Water Demand and Supply Analysis into General and Specific Plans	58
Subdivision Map Act	59
Local Ordinances to Address Water Availability.	60
Comprehensive Development Fee.	60
Water Use Off-Set	61
Water Budgeting Approach.	62
Role of the Local Agency Formation Commission	62
Water Resources Planning and CEQA	63
CEQA Guidelines	64
Water Supply and Land Use Legislation	65
Court Decisions	67
Stanislaus Natural Heritage Project v. County of Stanislaus (1996) 48 Cal. App. 4th 182	
County of Amador v. El Dorado County Water Agency (1999) 76 Cal. App. 4th 931	
Integrating Water Supply Issues into the Day-to-Day Development Review Process	69
What This Means for Land Use and Water Planners	70

CHAPTER 4

Analyzing Water Demands / 73

Need for Accurate Demand Estimating—Existing Demands	73
Need for Accurate Demand Estimating—Projected Demands	74
Methods Used to Determine Water Demands	75
Population-Based Projections	75
Socioeconomic Modeling	75
Land Use Method.	76
Coordination with Land Use Planning Efforts	76
Developing Land Use-Based Water Demands	77
Boundaries	78
Existing Land Uses	78
Future Land Uses.	81
Land Use Unit Demands.	83
Unaccounted-for Water	85
High-Volume Water Users	87
Applying Unit Demands to Land Uses.	87
Calibrating and Normalizing Existing Demands.	88
Future Land Use Unit Demands	90
Phasing Demands and Planning Horizons	92
Demands Management	94
Benefits of Conservation	95
Conservation Best Management Practices.	96
Designing a Conservation Program.	97
Plumbing Code Upgrades	97
Screening	97
Potential Water Savings	97
Benefits.	98
Costs.	99
Benefit-Cost Analysis	99
Dealing with Uncertainty	100
Other Applications of the Land Use-Based Approach	101

Contents

CHAPTER 5

Evaluating Water Supplies / 103

Supply Sources in California	103
Groundwater	104
Surface Supplies	106
Facilities	107
Water Rights	107
Primary Water Purveyors	108
Recycled Water	109
Indirect Potable Reuse	109
Seawater Barrier	110
Third-Party Impacts	110
Determining the Availability of Supplies	111
Long-Term, Average-Year Supplies	111
Groundwater	111
Surface Water	112
Comparing Supplies with Demands	113
Dry Year and Seasonal Availability	
Type of Year	113
Surface Water	114
Groundwater	115
Comparing Supplies with Demands	115
Potable and Non-Potable Supplies	116
System Reliability Following Catastrophic and Other Events	117
Seismic Vulnerability	117
Flooding Contamination	118
Seawater Intrusion	118
Chemical Contamination	119
Wildfire	119
Terrorism	119

New Opportunities for Water Supplies and Supply Management	119
Conjunctive Use of Ground and Surface Waters	120
Water Purchases, Transfers, and Banking	122
Water Marketing and Banking	122
Third-Party Impacts	123
Water Marketing Approvals	123
Conservation Savings Sales	124
Exchange Agreements	124
Land Following	124
Desalination and Demineralization	125
Off-Stream Storage and Expansion of Existing Reservoirs	127
Gray Water	128

CHAPTER 6

Preparing an Integrated Water Resources Plan / 129

Integrated Water Resources Planning	129
Environmental Compliance Considerations	130
Why Integrated System Planning Makes Sense	132
Establishing Goals	132
Alternatives Development	133
Evaluation Criteria	134
Developing Alternatives	134
Evaluating Alternatives	136
Strategies for Water Supply and Demand	137
Moving from Project Planning to Implementation	140
Criteria for Establishing Priority Recommendations	141
Phasing and Scheduling Plan	141
Financing Plan	141
Environmental Compliance and Permitting Requirements	142
Stakeholder Involvement	143

Contents

CHAPTER 7

Linking Water Quality Protection with Land Use / 145

What Is Watershed Planning?	146
Drinking Water Source Protection	146
Other Watershed Trends	147
Integrating Multiple Goals in Watershed Planning	148
Multiple Goals	148
Conflicting Goals	149
Multipurpose Reservoirs	149
Reservoir Operations and Habitat	149
Wetlands Created from Leakage	150
Detention Basins and Organic Pollutant Loadings	150
Watershed Planning Process	150
Characterizing a Watershed	151
Data Management	151
Delineation of a Watershed or Groundwater Protection Zone	152
Surface Water	152
Groundwater	152
Linkage Between Land Uses/ Activities and Water Quality Impacts	153
Natural Watershed Characteristics	153
Vegetation	154
Geologic Conditions	154
Rainfall Intensity	155
Wildlife	155
Wildfire	155
Watershed Characteristics	156
Highways, Streets, and Parking Lots	156
Sanitation Facilities	156
Livestock Grazing	156
Chemicals	156
Impervious Surfaces	157
Prioritizing Contaminants and Sources	158
Assessing Watershed Susceptibility Conditions	158
Utilizing Land Management and Institutional Controls	159

Land Management for Source Reduction, Flow Controls, and Treatment	159
Source Reduction	162
Flow Management and Treatment	162
Urban Design Solutions	163
Integrating Protection of Stormwater Quality into Site Design	165
Institutional Controls	169
General Plans, Specific Plans, Ordinances, and Other Land Development Controls	171
Stream and Riparian Setbacks and Buffer Zones	173
Effluent Trading	174

CHAPTER 8

Towards Collaborative Water Planning / 175

The Traditional Approach	176
A Primer on Collaborative Public Policy Development	177
Definitions and Principles	177
Collaborative Policy Development	177
Five Typical Stages of a Collaborative Process	178
A Few Common Principles	181
Representation and Inclusiveness	181
Charters and Ground Rules	181
Ground Rules	182
Separating Interests from Positions or Postures	183
Inventing Options for Mutual Gain and Interdependent/Linked Agreements	183
Alternatives to a Negotiated Solution	184
Organizing a Process with Adequate Time, Resources, and a Communication Strategy	184
Common Issues in Water Resources Planning	184
Resolving Technical Disputes	184
Settling Disagreements Over Assumptions, Baseline Conditions, and Methods	185
Importance of Goals, Objectives, or Principles	186
Developing, Evaluating, and Packaging Alternatives	186
Assurances and Monitoring	187

Contents

Summary	188
Case Studies	188
Water Forum	189
The Collaborative Process	189
The Agreement	190
Conclusions	193
CALFED Bay-Delta Program	194
The Collaborative Process	195
The CALFED Program	196
Conclusion	197
New Melones Lake Resource Management Plan	198
What Might the Future Hold?	201
Appendices	
Appendix A	205
Institutional Framework for Allocating and Managing Water Resources	
Appendix B	215
Model Urban Water Management Plan— City of New Albion, 2000	
Appendix C	237
Senate Bill 221 and Senate Bill 610	
Appendix D	249
Memorandum of Understanding— Urban Water Conservation in California	
Appendix E	267
Flow Charts Illustrating the NEPA and CEQA Environmental Review Processes	
Appendix F	271
Water Quality Vulnerability Zone Development—San Francisco PUC Technical Memorandum	
Appendix G	281
Examples of Collaborative Water and Policy Planning	
Glossary	287
Abbreviations and Acronyms	293
References	295
Index	299
Credits	308

Short Articles

Important Water Events in California	5
EBMUD at the Center of the Storm	15
Using the California Water Plan	24
The MTBE Saga	33
Recommended Contents for an Urban Water Management Plan	36
Required Groundwater Information in an Urban Water Management Plan	37
1990 Water Conservation in Landscaping Act	43
AB 3030 Groundwater Management Plan Procedure	49
Recent Changes to Groundwater Management Legislation	51
Why Have a Water Element as Part of the General Plan?	56
Sacramento County's Concurrency Policies	57
University of California, Davis Water Management Plan	58
Land Use Planners and Water Purveyors Need to Communicate	59
Unanswered Questions	60
Focusing a Specific Plan on Stream Protection—The Soquel Village Specific Plan	61
CEQA in a Nutshell	64
Historical Background for Linking Water Supply and Land Use for Development Projects	66
The Water Forum Successor Effort Water Accounting Procedures	69
The Development Pipeline	71
Soquel Creek Water District Integrated Resource Plan	76
Dougherty Valley	78
Distribution System Hydraulic Model	80
The Los Vaqueros Reservoir	82
Surface Water Supply Update for Western Placer County	89
EBMUD's Land Use-Based Approach to Demands	91
Urban Water Conservation Certification	98

Contents

Short Articles continued

Land Subsidence from Overdrafting	107
MWD's Incentive to Recycle Water	110
Sacramento Groundwater Authority Conjunctive Use Program	122
Water Banking	124
California Bay-Delta Environmental Water Account	126
Distribution System Hydraulic Models	135
Justification or Need for Project	136
Metropolitan Water District Strategy	138
Assessing the Risk of Shortage versus Developing New Supply	139
San Francisco Water Quality Vulnerability Zone Development	160
Education Efforts in Santa Cruz County	163
Village Homes' Innovative Drainage Design	170
Erosion Control in the Wine Country	172
City of Oakland's Creek Protection Ordinance	173
Conditions Favorable for Successful Policy Collaboration	178
Understanding Alternatives to Negotiation—Napa River Watershed Plan	181
Groundwater in Goleta	182

Figures

1-1 California's Regional Imports and Exports of Water	3
1-2 Possible Shortfalls by Region for the Year 2020	19
2-1 Basins with Groundwater Management Institutions in California.	48
3-1 General Comparison of Land Use Planning and Water Use Planning in California.	54
3-2 Sacramento Water Forum Procedure for Incorporating Water Supply Information into Development Proposals	70
4-1 Overview of Land Use Model	77
4-2 Methodology for Distributing Existing Contra Costa Water District Treated Water Demands	79
4-3 GIS Layers Needed for Demand Estimating	80
4-4 Existing Land Use Layers	81
4-5 Methodology for Projecting Future CCWD Treated Water Demands	83
4-6 Urban Applied Water Use by Sector	84
4-7 Sources of Unaccounted-for Water	85
4-8 Overview of Process	92
4-9 Calculation of Existing LUDs.	93
4-10 Typical Seasonal Hydrograph—Urban Water Demand	96
4-11 Typical Single-Family Residential Water Usage	97
4-12 Conservation Effects on Facilities Planning.	99
4-13 Definition of Cost Savings for Conservation Analyses	100
5-1 Groundwater Use and Recharge	105
5-2 San Joaquin Rivers Unimpaired Runoff Data	112
5-3 Annual Demands and Supply Availability.	114
5-4 California's Multi-Year Historical Dry Periods (1850–present)	115

Contents

Figures continued

5-5	Supply Availability—Selected Year	116
5-6	Overview of Geologic Vulnerabilities.	117
5-7	How Seawater Can Be Induced into an Aquifer in the Salinas Valley	118
5-8	Conjunctive Use Operating Strategy	120
6-1	Integrated Resource Plan Process	131
6-2	Link Between Master Plan and Planning Data	135
6-3	An Example of Supply Planning Project Components	136
6-4	Land Use Data Are Important to an Accurate Hydraulic Model.	137
6-5	Average Unit Cost of Alternatives	138
7-1	Composited Data Used for Watershed Analysis	152
7-2	Watershed Delineation	152
7-3	Example of a Relationship Between a Land Use and Water Quality	153
7-4	San Francisco Watershed Management Planning Process	160
7-5	Composited Water Quality Vulnerability Zones	161
7-6	Residential Neighborhood Design with Multiple Use Retention Basin.	164
7-7	Residential Site Designed for Maximum Permeability.	166
7-8	Residential Infill Site Showing Low-Impact Stormwater Management Features.	167
7-9	Use of a Vegetated Concave Island to Absorb Stormwater in a Small Residential Cul-de-Sac	167
7-10	Neighborhood-Scale Ideas for Stormwater Management	168
7-11	Street and Parking Lot Treatment for Stormwater Management	169
8-1	Five Typical Stages of the Collaborative Process	179
8-2	Program Elements	196

Tables

1-1	California Net Water Supplies.	2
2-1	Statutes and Institutions Allocating, Managing, and Planning California’s Water Resources.	25
2-2	Basins with Groundwater Management Institutions in California.	47
4-1	Average Unit Demands for a Moderate Climate Area	85
4-2	Unaccounted-for Water.	86
4-3	Calculating Demands.	88
4-4	Urban BMPs	96
5-1	Annual Agricultural and Municipal Water Demands Met by Groundwater	105
5-2	Hydrologic Model Uses and Data Requirements	113
6-1	Comparing Alternatives Against Criteria.	137
6-2	Quantifying Alternatives Against Criteria.	137
7-1	Relationship Between Contaminant Sources and Water Quality Concerns	157
8-1	CALFED-Bay Delta Agencies	195
8-2	New Melones Reservoir Resource Management Elements	200

Preface

We believe this book is long overdue. It links water resources and land use planning, two subjects that historically have been addressed separately and dealt with by separate agencies, departments, and professionals. This book bridges the gap between those who plan for California's water future and those who plan for the state's land use future.

What This Book Is About

The book is both a basic information source and a "how to" handbook for anyone interested in water resources planning and management.

Chapter 1 offers a glimpse of California's water history as it applies to land use and urban development, and provides background on why linkages between water and land use are so critical. The chapter also describes why connections between growth and water supply have not occurred in the past, and offers a set of themes that define today's complex environment.

Chapters 2 and 3 summarize the vast array of statutes, requirements, policies, and practices that water planners and land use planners need to know. Chapter 2 identifies statutes, regulations, and practices that apply to long-range water planning, including recent legislation linking supply and growth, and chapter 3 describes California's various land use planning and zoning laws, requirements, and practices that relate to resources. Together, the two chapters provide a framework for integrating land use plans and decisions with water resources.

Chapters 4, 5, and 6 serve as a technical handbook that shows how to integrate water planning and land use planning comprehensively and analytically. Chapter 4 explains how to conduct detailed water demand analyses that can be used to meet a variety of planning and regulatory requirements. The methodology used for these studies reflects the state-of-the-art in

demand projection that is likely to become the standard approach for all water purveyors in the future.

Chapter 5 defines the available water sources in California, and describes how to assess the reliability of supply for various types of water years. The chapter also shows how to integrate new and emerging supply choices into future water scenarios.

Chapter 6, which explains the principles and process of Integrated Resource Planning, brings demand and supply together. It also demonstrates how to package a set of programs, projects, and actions into resource alternatives that can be communicated to and evaluated by the public and other agencies and reviewers.

Chapter 7 discusses the water quality considerations that must be integrated into land use and water planning, and identifies the key features and variables of a watershed approach to source protection. In addition, the chapter offers suggestions for practical urban design that can integrate resource protection strategies into the built environment.

Chapter 8 recognizes today's reality that working collaboratively with a variety of interests, agencies, and stakeholders is both necessary and valuable. The chapter offers a framework for understanding and participating in collaborative decision-making processes in water policy and land use that facilitators, watershed coordinators, planners, analysts, and anyone else involved in multi-party, multi-agency programs or projects will find useful.

Who Might Benefit from This Book?

This book is meant to meet the needs of many different professionals working in California in the water or land use arena.

For the land use planner “in the trenches” at a city, county, or regional agency, the book provides a snapshot of California's water supply and water quality issues, and describes the laws, tools, and approaches planners use or should use as they plan for water. In particular, chapters 1 and 2 offer background on California water and the many laws and environmental requirements which planners need to know. Chapters 4 through 6 are useful in providing a detailed, step-by-step methodology to meet recent legislative requirements for linking water supply and land use decisions. Chapter 7 illustrates innovative design features for capturing and cleaning up urban runoff, which is becoming particularly critical as stormwater permitting requirements expand.

For the water resources planner, consultant, or engineer, the book offers a glimpse into the world of land use planning and describes how water resources fit into the structure necessary for creating California's future communities. It serves as a step-by-step guide for data collection, analysis, and

planning techniques, and suggests an approach for preparing an integrated resources plan. Those already familiar with water issues in California will benefit from chapter 3's description of the land use process and planning requirements and, in particular, from suggestions for integrating resource planning into both long-term and day-to-day development. In addition, chapter 4 presents a detailed methodology for linking land use planning with water demand projection that can identify the need for new water supply or infrastructure improvement, at the same time minimizing the perception of growth inducement. Information about and approaches to managing and analyzing water supplies, described in chapter 5, will support the efforts of planners to craft an integrated approach, described in chapter 6, that can guide decisionmaking.

For the water conservation specialist, environmental professional, water supply engineer, and resource manager, the book identifies ways to stretch California's existing water supply, develop new sources that have a minimal effect on the environment, and link resource decisions with the California Environmental Quality Act and other similar laws. Chapters 2 and 3 present the legislative basis for these considerations, while chapters 4, 5, and 6 describe efficiency measures that can be implemented in a water planning process along with other related environmental standards.

Watershed planners and drinking water source protection engineers will find chapters 7 and 8 particularly relevant. Chapter 7 examines the linkage between various land uses and their effect on water quality, with an overview of suggested management practice. Chapter 8 discusses how to establish and work within collaborative groups and multi-agency/multi-stakeholder situations.

For the attorney, policy specialist, decisionmaker, or state or federal government official, the book is a "one-stop shop" for laws, policies, regulations, and best practices that influence water resource planning as it relates to land use and urban growth. In particular, chapters 2 and 3 illustrates the types of water planning and land use planning, respectively, that is done at the local government level. Chapters 5 and 6 shows how to integrate supply opportunities into a comprehensive long-range plan, given the uncertainties and risks with water planning in California.

For all readers, this book suggests hundreds of information sources and references (including many that are Internet-based), along with numerous case studies that have shaped water issues. These seminal studies offer a starting point for thinking about the water resources and land use challenges we face as a society.

The Authors' Goals

This book does not present a particular political philosophy or agenda. It is intended as a building block to protect and enhance the quality of California's

future environment and, for that matter, of any state wishing to optimize its water supplies. The authors are committed to protecting and restoring the streams, rivers, wetlands, and other aquatic resources that contribute enormously to the habitat and quality of our state. At the same time, we are equally committed to sustaining California's communities and economic well being with thoughtful future water and land use planning. And finally, we are unabashedly interested in community equity. Water solutions should be cost-effective. This is not to say that we should avoid paying the environmental and social costs of water production, but we should be ever mindful of the costs to urban and farm users alike. For those versed in the tenets of sustainability, this prescription will look familiar: environment, economy, and equity—referred to as the three “e’s” of sustainability—addressed as a package.

For many in the no-growth or environmental community, this book may read like a prescription for building more water projects and freeing up resources for more population growth and, ultimately, the demise of the state's natural resources. We think differently. The population is here and growing. Many of us may personally lament that fact, but to avoid thoughtful water planning in the hope that the population will not come to the state or to our community is to ensure the demise of our natural heritage. Water *is* the California crisis of the next fifty years. We can either continue with outmoded solutions that have resulted in environmental and economic problems and endless legal stalemates, or we can move toward more analytical, creative, and inclusive management of resources.

For many in the economic development community, the book may read like a treatise on how to entangle plans and projects in lengthy regulatory reviews and processes of public involvement, and how to avoid the real choices of new reservoirs, dams, and pipelines. We think differently. We seek to stretch what we have through conservation, reuse, and recycling, transfers, and conjunctive use of ground and surface water. But we understand that management of existing sources alone cannot meet future need. We support the development of new water sources or storage of winter flows where they are cost-effective and result in the fewest negative environmental and community effects. We do not believe, for example, that the robust agricultural industry should simply step aside and sell its water to satisfy insatiable urban thirst. Yet, where appropriate, water transfers can be part of our future. Developing the *right* source when and where it is needed can accomplish the three “e’s” of sustainability. A groundwater basin, for example, can serve as storage, avoiding the impact a new on-stream reservoir has on habitat. Recycling can provide water for specific uses, saving precious potable water for drinking.

There is plenty of room for pessimism. With 12 million new Californians in the next 20 years, with water shortages predicted as high as 2 to 4 million

acre feet annually (in a normal year!), and with potentially less favorable hydrologic conditions, one could easily paint a doomsday picture. But we are decidedly optimistic. Working together, stakeholders from the environmental, business, water, and public communities can craft solutions that offer a sustained water future for the state.

We can accept no less.

Karen E. Johnson

Jeff Loux

August 2004