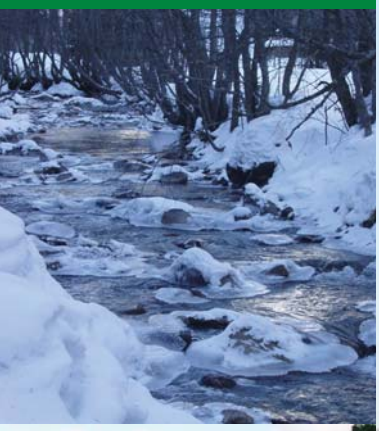
Climate Change Handbook for Regional Water Planning



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US Environmental Protection Agency Region 9
and
California Department of Water Resources

In partnership with:
US Army Corps of Engineers South Pacific Division
Resources Legacy Fund
US Environmental Protection Agency Office of Research and Development

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This handbook and a searchable database of climate change resources can be downloaded from:

http://www.water.ca.gov/climatechange/CCHandbook.cfm

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Foreword

As the science of climate change quickly develops and evolves, watershed planning practitioners face the challenge of interpreting new information and discerning which methods and approaches are more appropriate for their planning needs. This handbook offers an innovative analytical framework for incorporating climate change impacts into a regional and watershed planning process. This handbook was developed as a partnership of the U.S. Environmental Protection Agency (EPA) Region 9, the California Department of Water Resources, U.S. Army Corps of Engineers South Pacific Division, and the Resources Legacy Fund. Although this handbook is focused on the California Integrated Regional Water Management Planning (IRWMP) process, it can be used by other practitioners nationally and internationally when incorporating climate change into any watershed or water supply planning process.

This handbook considers both climate change adaptation (reduction of impacts) and mitigation [greenhouse gas (GHG) reduction]. Quantitative tools and techniques for addressing both are introduced and discussed in order to prepare comprehensive IRWMPs. A guide to assess the vulnerability of a watershed or region to climate change impacts is presented in this handbook, and guidelines to prioritize vulnerabilities are introduced. This handbook relies on approaches that have been developed and applied to regional watershed planning processes. This handbook also presents case studies that provide illustrative examples in which the latest science and methods on climate change, including uncertainty and adaptive management approaches, have been applied outside academia. While the available suite of climate change tools and analytical techniques for incorporating climate change is continually advancing and improving, the underlying planning processes outlined in this handbook should continue to provide a solid basis for comprehensive watershed planning. Improved decisions about water resources management systems, whether adapting them to future climate change or mitigating climate change through reductions in GHG emissions, should result from application of the framework in this handbook. This handbook presents the range of decisions that need to be made and the factors that go into making those decisions at a local or regional level.

During implementation of the decision support framework that is presented in this handbook, planners must consider the suite of available tools and the abilities and resources available to the regional/watershed planning group. The long-term goal of this handbook is to serve as a foundation for a thoughtful planning process for incorporating climate change impacts into IRWMPs and other regional and watershed management planning processes.

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Acronyms

AB	Assembly Bill
ACR	American Carbon Registry
AFY	Acre-Feet per Year
AMWA	Association of Metropolitan Water Agencies
APCD	Air Pollution Control District
AQMD	Air Quality Management District
AWWA	American Water Works Association
BCSD	Bias-Corrected Spatial Downscaling
BCT	Bonneville Cutthroat Trout
BDCP	Bay Delta Conservation Plan
BOR	U.S. Bureau of Reclamation
CA	Constructed Analogue
CABY	Consumnes, American, Bear, and Yuba Rivers
CalEPA	California Environmental Protection Agency
CAPCOA	California Air Pollution Control Officers Association
CAR	Climate Action Reserve
CARB	California Air Resources Board
CAT	Climate Action Team
CBO	Congressional Budget Office
CCAR	California Climate Action Registry
CCCC	California Climate Change Center
CCSP	Climate Change Science Program
CDFs	Cumulative Distribution Functions
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CH_4	Methane
CMIP3	Coupled Model Intercomparison Project Phase 3
CNRA	California Natural Resources Agency
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalents
CO-CAT	Coastal and Ocean Working Group of the California Climate Action Team
CPS	Central Puget Sound
CRA	Colorado River Aqueduct
CRE	Climate Ready Estuaries
CREAT	Climate Resilience Evaluation Awareness Tool
CRWU	Climate Ready Water Utilities
CUP+	Consumptive Use Program
CVFPP	Central Valley Flood Protection Plan
CVP	Central Valley Project
CWC	California Water Code
CWP	California Water Plan
DAC	Disadvantaged Community
Degree F	Degree Fahrenheit
Delta	Sacramento-San Joaquin Delta
DHSVM	Distributed Hydrology Soil Vegetation Model
DO	Dissolved Oxygen
DRMS	Delta Risk Management Study

DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
eGRID	Emissions & Generation Resource Integrated Database
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ET	Evapotranspiration
ETc	Crop-Specific Evapotranspiration
ETo	Reference Evapotranspiration
EWMP	Efficient Water Management Practice
FAO	Food and Agriculture Organization of the United Nations
FEMA	Federal Emergency Management Agency
GCM	General Circulation Model
GHG	Greenhouse gas
GWh	Gigawatt Hours
HFC	Hydrofluorocarbon
IEUA	Inland Empire Utilities Agency
IPCC	Intergovernmental Panel on Climate Change
IRP	Integrated Resource Plan
IRWD	Irvine Ranch Water District
IRWM	Integrated Regional Water Management
IRWMP	Integrated Regional Water Management Plan
LADWP	Los Angeles Department of Water and Power
LEED	Leadership in Energy and Environmental Design
M&I	Municipal & Industrial
MART	Multi-Attribute Rating Technique
MWD	Metropolitan Water District of Southern California
N_2O	Nitrous Oxide
NAS	National Academy of Sciences
NF_3	Nitrogen Trifluoride
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NRDC	Natural Resources Defense Council
NWF	National Wildlife Federation
OPC	California Ocean Protection Council
PFC	Perfluorocarbon
PIER	Public Interest Energy Research Program
PPIC	Public Policy Institute of California
PWP	Pasadena Water and Power
RDM	Robust Decision Making
RMS	Regional Management Strategy
SANDAG	San Diego Association of Governments
SCWA	Sonoma County Water Agency
SF_6	Sulfur Hexafluoride
SIMETAW	Simulation of Evapotranspiration of Applied Water
SLAMM	Sea Level Affecting Marshes Model
SMBRC	Santa Monica Bay Restoration Commission
SNA	Sierra Nevada Alliance
SPU	Seattle Public Utilities
SRES	Special Report on Emissions Scenarios
SSJDD	Sacramento-San Joaquin Drainage District

SWCCI	Southwest Climate Change Initiative
SWP	State Water Project
TCR	The Climate Registry
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
UNSW	University of New South Wales
USCCSP	US Climate Change Science Program
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
VIC	Variable Infiltration Capacity
WBCSD	World Business Council for Sustainable Development
WCRP	World Climate Research Program
WEAP	Water Evaluation and Planning Model
WERF	Water and Environment Research Foundation
WET-CAT	Water Energy Subgroup of the Climate Action Team
WRI	World Resources Institute
WSF	Central Puget Sound Water Supply Forum
WSMP	Water Supply Management Program
WSO	Central Puget Sound Water Supply Outlook
WUCA	Water Utility Climate Alliance

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