

Section M: Technical Analysis

The purpose of the Technical Analysis standard as stated in the Proposition 84/1E Integrated Regional Water Management (IRWM) Program Guidelines is to explain the technical information, methods, and analyses used by the Regional Water Management Group (RWMG) to understand the water management needs over the planning horizon.

M.1 TECHNICAL INFORMATION USED IN THE IRWM PLAN

The RWMG relies almost entirely on existing plans, reports, and studies as a basis for understanding current water resource conditions in the Greater Monterey County IRWM planning region and for developing the IRWM Plan. The background information and technical data—including land use information, population studies and demographic information, economic data, water supply and water use data, environmental resources, and projected water demand—have been derived from the following types of plans and reports (among others):

- Urban Water Management Plans
- Water Master Plans
- Stormwater Management Plans
- Wastewater Management Plans
- Local Agency Formation Commission (LAFCO) Municipal Services Review Reports
- Department of Water Resources (DWR) Land Use Surveys
- Watershed Assessment and Management Plans
- Monterey County Water Resources Agency (MCWRA) Groundwater Extraction Summary Reports
- MCWRA Monterey County Floodplain Management Plan
- Monterey County General Plan and Specific Area Plans
- Regional Water Quality Control Board (RWQCB) plans, including 303(d) List
- Monterey Bay National Marine Sanctuary (MBNMS) Management Plan
- MBNMS Condition Report
- US Census decennial population data
- US Census/American Community Survey (ACS) five-year economic survey data
- Association of Monterey Bay Area Governments (AMBAG) economic reports
- Monterey County Agricultural Commissioner Crop Reports
- Research and technical studies conducted by local academic institutions and environmental consultants

Regional objectives have been informed by these and other planning documents, including MBNMS Water Quality Protection Program Action Plans, RWQCB Central Coast Basin Plan objectives, and the RWQCB Watershed Management Initiative.

The sources listed above have been used to describe historic and existing conditions in the Greater Monterey County IRWM region as well as to estimate future conditions—most importantly, future water demand—for the purposes of IRWM planning. The table below lists the sources of technical information used specifically to develop projected needs. Following the table is a brief description of these technical sources, and an explanation for why this technical information is representative and adequate for developing the IRWM Plan. All documents cited in this IRWM Plan are available to the public upon request.

Table M-1: Technical Information Used in the IRWM Plan

| Type of Study or Data | Source (Author/Title) | Technical Analysis or Method Used | Information Derived from Technical Analysis | Use in IRWM Plan |
|-----------------------------------|--|---|---|---|
| Economic data | US Census Bureau, American Community Survey, 2006-2010 | Five-year economic surveys | Median household income data (2010) for communities and census tracts in region. | Used to identify disadvantaged communities (DACs). |
| Historic population trends | US Census Bureau, population data from 1960 to 2010 (US Census website) | Decennial population surveys | Population for urban areas in region from 1960 to 2010. | Used as basis for estimating population growth, and for calculating future urban water demand in the Salinas Valley Groundwater Basin (using Method 1). |
| Population growth | AMBAG: 2008 Regional Forecast | Statistical analysis | Estimated population growth for urban areas in region, from 2020 to 2035. Population projections for Chualar 2030-2035 and for San Ardo, San Lucas, and “Other Areas” 2020-2035 were based on AMBAG projected growth rate for Unincorporated Monterey County. | Used as basis for determining future urban water demand in the Salinas Valley Groundwater Basin (using Method 1). |
| Population growth | Marina Coast Water District (MCWD): 2010 Urban Water Management Plan | Statistical analysis | Future population estimates for the MCWD service area. | Used as basis for determining future urban water demand in the Salinas Valley Groundwater Basin (using Method 1). |
| Ground and surface water modeling | MCWRA: Salinas Valley Integrated Ground and Surface Water Model (SVIGSM) Update, May 1997, Montgomery Watson | SVIGSM | Historic water use from the Salinas Valley Groundwater Basin: 1970-1994. | Used to establish historic water use trends in the Salinas Valley Groundwater Basin. |
| Groundwater use | MCWRA: Ground Water Extraction Summary Reports (GWESR) 1995-2010 | Review of existing records: data reported from well operators for agricultural and urban water uses | Historic water use from the Salinas Valley Groundwater Basin: 1995-2010. | Used to establish historic water use trends, to document current water use, and as a basis for estimating future water demand in the Salinas Valley Groundwater Basin (using Method 1). |

| Type of Study or Data | Source (Author/Title) | Technical Analysis or Method Used | Information Derived from Technical Analysis | Use in IRWM Plan |
|--|--|--|---|--|
| Urban water use | Urban Water Management Plans for: City of Greenfield (2008), King City (2010), Marina Coast (2010), California Water Service Company-Salinas District (2010), City of Soledad (2010) | Statistical analysis | Projected water use for urban areas in region, according to water purveyors as reflected in their Urban Water Management Plans. | Used as basis for estimating future urban water demand from the Salinas Valley Groundwater Basin (using Method 2). |
| Urban water use | RMC Water and Environment Survey, October 2005; and personal communications with water purveyors | Survey of water purveyors (statistical analysis and deductive reasoning) | Projected water use for urban areas in region (specifically, City of Gonzales, Castroville Community Services District, and Alcoserved portion of the City of Salinas), according to direct communication with individual water purveyors. | Used as basis for estimating future urban water demand from the Salinas Valley Groundwater Basin (using Method 2). |
| Land use trends: Monterey County | DWR Land Use Surveys: 1968-2005 | Aerial surveys and field verification | Land use trends in the region, specifically agricultural vs. urban vs. native land acreages, including irrigated and non-irrigated lands. | Used to establish land use trends, and as a basis for estimating future water demand in the region. |
| Land use trends: Crops | Monterey County Agricultural Commissioner's Office: Annual Crop Reports 1930 - 2010 | Review of existing records | Current crop acreages and historic crop trends in Monterey County. | Used to establish crop trends, and as a basis for estimating future agricultural water demand in the Salinas Valley Groundwater Basin. |
| Land use trends: Big Sur | Monterey County Planning Department: Big Sur Coast Local Coastal Plan (1986); and direct communication with Big Sur water suppliers | Statistical analysis and deductive reasoning | Land use trends together with population trends were used to conclude that water demand will most likely remain constant in the Big Sur region over the planning horizon. | Used to estimate future water demand in the Big Sur coastal region. |
| Groundwater and surface water modeling | MCWRA: Salinas Valley Integrated Ground and Surface Water Model Update, May 1997, Montgomery Watson | SVIGSM | Land use, water use, population trends, and other factors (including crop patterns, conversion of ag land to urban land, water efficiency increases, etc.) were used to conclude that agricultural water demand will most likely decline slightly and that urban water demand will increase considerably in the Salinas Valley over the planning horizon. | Used to estimate future agricultural and urban water demand in the year 2030 from the Salinas Valley Groundwater Basin (Method 3). |

| Type of Study or Data | Source (Author/Title) | Technical Analysis or Method Used | Information Derived from Technical Analysis | Use in IRWM Plan |
|---|---|--|---|---|
| Seawater intrusion | MCWRA: Memorandum from MCWRA to EPA Region IX, dated July 30, 2010, Subject: Technical Memorandum – SEAWATER INTRUSION, 2010 | Groundwater sampling from coastal wells | Mineral content of groundwater at various well locations and depths, resulting in seawater intrusion maps (using isochloride contours). | Used to document the extent of seawater intrusion in the Salinas Valley Groundwater Basin, as well as the projected intrusion rate, to understand future groundwater supply conditions. |
| Local projections of changes in climate variables | Cal-adapt Web Tool - http://cal-adapt.org/ | Cal-Adapt allows the user to identify potential climate change risks in specific geographic areas throughout the state | Local projections of changes in rainfall, average temperature, evapotranspiration, surface flows. | Used to define how various climate variables are projected to change within the Greater Monterey County IRWM region and their effect on water resources. |
| Climate vulnerabilities | Climate Change Handbook, 2011, www.water.ca.gov/climatechange/cchandbook.cfm | Assessing regional vulnerability to climate change | Prioritization of potential environmental vulnerabilities. | Used to define most critical environmental variables from which to focus Climate Risk Assessment and future studies. |
| Climate risk assessment | International Council for Local Environmental Initiatives (ICLEI) Climate Adaptation Planning Workbook | ICLEI Risk Assessment protocol | Identify high risk infrastructure and water resources | Used to help prioritize future adaptation strategies for high-risk resources. |
| Developing climate adaptation strategies | California Natural Resources Agency's 2009 <i>California Climate Adaptation Strategy</i> | Evaluating appropriate adaptation strategies for the region, based on the risk assessment | Recommended adaptation actions and response scenarios | Used to help prioritize future adaptation strategies for high-risk resources. |

M.2 DESCRIPTION OF TECHNICAL INFORMATION SOURCES

The following provides a brief description of the technical sources used to develop projected water management needs in the Greater Monterey County IRWM planning region, and an explanation for why this technical information is representative and adequate for developing the IRWM Plan.

M.2.1 Population Data

U.S. Census Bureau Data: The U.S. Census decennial population data have been derived from the U.S. Census Bureau website.¹ Economic data—in particular, median household income (MHI) and poverty status—have been derived from the American Community Survey (ACS) five-year survey, for 2006-2010. ACS is an ongoing statistical survey by the U.S. Census Bureau, sent to approximately 250,000 addresses monthly (or 3 million per year). It regularly gathers information previously contained only in the long form of the decennial census. MHI was measured in 2010 inflation-adjusted dollars. DACs are defined as communities that had a MHI in 2010 of less than 80 percent the statewide MHI. “Severely DACs” are defined as communities that had a MHI in 2010 of less than 60 percent the statewide MHI. DACs were identified both on the community level and tract level. The U.S. Census data are a trusted and broadly accepted source of population, demographic, and economic data, and the data used in the IRWM Plan are the latest U.S. Census data available. Therefore these data are considered representative and adequate for developing the IRWM Plan.

Association of Monterey Bay Area Governments 2008 Regional Forecast: As required by state law, the regional planning agency AMBAG produces a regional forecast approximately every five years of population, housing, and employment for a region spanning the counties of Monterey, San Benito and Santa Cruz. Each forecast is produced with the best available data and is extensively reviewed by AMBAG’s member agencies. The 2008 Regional Forecast provides detailed population, housing and employment projections for every jurisdiction in the Monterey Bay region through 2035. The forecast is developed using professionally accepted forecasting methodologies, and represents the most likely trend in population, housing units, and employment. As such, the forecast is broadly accepted as a basis for supporting official regional planning efforts.

M.2.2 Water Supply, Water Use, and Projected Water Demand

Seawater Intrusion Technical Memorandum: The “Memorandum from MCWRA to EPA Region IX, dated July 30, 2010, Subject: Technical Memorandum – SEAWATER INTRUSION” has been used along with the most recent seawater intrusion maps to provide an understanding of the extent of seawater intrusion in the Salinas Valley Groundwater Basin. The phenomenon of seawater intrusion was first noticed in the early 1930s and was documented in 1946 in Bulletin 52, an investigation of the Salinas Basin (DWR 1946). The MCWRA has implemented several programs aimed at slowing the rate of seawater intrusion, and conducts annual sampling of groundwater wells in the coastal region to monitor the advancement of seawater intrusion. The Coastal Sampling Program includes agricultural wells in the Pressure 180-Foot, 400-Foot, and Deep Aquifers, as well as the East Side Shallow and Deep Aquifers. The MCWRA samples these wells annually during the peak agricultural production season (June through September) when pumping stresses are at their highest. The memorandum and isochloride contour maps used in this IRWM Plan represent the most current information available on seawater intrusion.

MCWRA Ground Water Extraction Summary Reports: The purpose of the GWESR is to summarize data submitted to the MCWRA by well operators on an annual basis from Ground Water Extraction Reports (agricultural and urban), Water Conservation Plans (agricultural and urban), and Water and Land

¹ U.S. Census Bureau website: <http://factfinder2.census.gov/>.

Use Forms (agricultural). The report is intended to present a synopsis of current water extraction within the Salinas Valley, including agricultural and urban water conservation improvements that are being implemented to reduce the total amount of water pumped. While the MCWRA makes every effort to ensure the accuracy of the data presented in the report, it should be noted that the data is submitted by individual reporting parties and is not verified by Agency staff. The MCWRA maintains strict quality assurance in the compilation, standardization, and entry of the data received. In the 2010 reporting year, the MCWRA received GWESR from 97 percent of the 1846 wells in the Salinas Valley for the 2010 reporting year. Agricultural and Urban Water Conservation Plan submittals for 2011 were 94 percent and 95 percent, respectively. In this IRWM Plan, GWESR are used to establish historic water use trends, document current water use, and as a basis for projecting future water demand in the Salinas Valley Groundwater Basin. The GWESR represents the only reliable source of groundwater extraction information in the region. Therefore these data are considered representative and adequate for developing the IRWM Plan.

Urban Water Management Plans: All urban water suppliers as defined in Section 10617 (including wholesalers), either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet (AF) annually are required to prepare an Urban Water Management Plan (UWMP). The UWMP serves as a long-range planning document for water supply, source data for development of a regional water plan, and a source document for cities and counties as they prepare their General Plans. UWMPs include a description of the service area (including population served), historical and current water demand and water demand projections, an overview of water system supplies (including purchased water, surface water, groundwater, recycled water, desalinated water, and water transfers), water supply reliability and water shortage contingency plans, and conservation master plans, among other topics. UWMPs for the following water districts have been used in the development of this IRWM Plan: City of Greenfield (2008), King City (2010), Marina Coast (2010), California Water Service Company-Salinas District (2010), City of Soledad (2010). Information from these UWMPs has been used to describe water systems and to establish future water demand for urban areas in the Greater Monterey County IRWM region.

Salinas Valley Integrated Ground and Surface Water Model Update (1997): The MCWRA initiated development of the Salinas River Basin Management Plan in 1996 with the specific goals to: stop seawater intrusion; create a long-term balance between recharge and withdrawal in the Salinas Valley Groundwater Basin; and provide a sufficient water supply in the Salinas Valley to the year 2030. The SVIGSM is a hydrologic/operational model that simulates the groundwater and surface water flows and their interaction in the Salinas Valley. The SVIGSM was developed to be the primary analytical tool to analyze the hydrologic and operational impacts of various alternatives presented in the Salinas River Basin Management Plan. The SVIGSM was used to provide a better understanding of the nature of the physical and hydrological processes that govern the groundwater flow system in the Salinas Valley Groundwater Basin, and to analyze the hydrologic impacts of the Salinas Valley Basin Management Plan. Although the SVIGSM was last updated in 1997, it is still considered by MCWRA staff to be the best and most valuable water resource planning tool for managing the Salinas Valley Groundwater Basin, and is therefore considered adequate for use in this IRWM Plan.

M.2.3 Land Use Trends

Department of Water Resources Land Use Surveys: DWR land use surveys are typically performed every seven years throughout the state of California and consist of aerial surveys followed by field verification. The main emphasis of DWR's land use surveys is the mapping of agricultural land. Over 70 different crops or crop categories are included in the surveys. Urban and native vegetation (undeveloped) areas are also mapped, though not to the level of detail of agricultural land. The land use surveys are performed using aerial photos and, more recently, satellite imagery to define field boundaries. For this

IRWM Plan, land use surveys from 1968-2005 were used to provide an understanding of agricultural vs. urban lands in the region and as a basis for projecting future land use trends (and therefore, projected water use). The 2005 land use surveys are the latest data available for this region.

Monterey County Agricultural Commissioner Crop Reports: Annual Crop Reports published by the Monterey County Agricultural Commissioner’s Office from 1930-2010 have been used in this IRWM Plan to document crop acreage trends and to establish the importance of agriculture for Monterey County’s economy. The Crop Reports include acreages, production, and revenues for: vegetable crops, fruit and nut crops, seed production, apiary production, livestock and poultry, cut flowers and cut foliage, nursery products, and field crops. The Crop Reports also include Monterey County export information and a summary of gross production values. The Crop Reports are considered the most reliable source of summary information for crop acreages and crop values in the county, and are therefore considered representative and adequate for use in this IRWM Plan.

M.2.4 Climate Change

Many climate models have been generated to predict changes in ocean and land temperature, rain frequency and intensity, coastal wave exposure, and sea level rise. Modeling using regional climate models (RCMs) has matured over the past decade to enable meaningful climate vulnerability assessment applications. California has created several web-based interfaces to help local and regional planners “downscale” climate models for local planning purposes. The Cal-Adapt website provides a geographically based climate model interpretation tool that generates predictive changes to various climate variables using different Intergovernmental Panel on Climate Change (IPCC) greenhouse gas (GHG) emissions projections. Specifically, emissions scenarios A2 and B1 coincide, respectively, with emission rates consistent with current rates of increase and with emission rates associated with global success at curbing emissions as prescribed within international climate treaties.²

The Pacific Institute study (*California Vulnerabilities to Sea Level Rise*, 2009) provides an analysis of coastal resources, human populations, infrastructure, and property that is at risk from projected sea level rise if no actions are taken. The study provides data regarding the cumulative impacts of increased watershed flooding, sea level rise, and storm surge, and shows how these cumulative effects can impact coastal areas for each United States Geological Survey (USGS) Quadrangle map of the California Coast.

The RWMG used the California Natural Resources Agency’s *2009 California Climate Adaptation Strategy* to develop an adaptation strategy for the Greater Monterey County IRWM region. Adaptation actions and response scenarios from were selected from this document as applicable to the Greater Monterey County region. High priority responses along with climate mitigation actions are listed in Section R, Table R-10, “Adaptation and Response Strategies Based on Risk Assessment.”

M.3 DATA GAPS

Each technical information source that has been used in the development of this IRWM Plan represents the latest or most currently available information available for that source. Each source is broadly considered to be a reliable and acceptable source of information by water resource managers and related

² These emissions scenarios are described in the 2009 California Climate Adaptation Strategy (California Natural Resources Agency) as follows: “One scenario depicts a higher-emissions scenario (A2), the other a lower-emissions scenario (B1). The A2 scenario represents a more competitive world that lacks cooperation in development and portrays a future in which economic growth is uneven, leading to a growing income gap between developed and developing parts of the world. The B1 scenario denotes a future that reflects a high level of environmental and social consciousness combined with global cooperation for sustainable development.”

professionals in the field. Thus, the information and data that have been used are considered to be representative and adequate for the development of this IRWM Plan.

Nonetheless, some data gaps do exist:

- *Environmental water needs:* Environmental water needs must be taken into consideration alongside agricultural and urban water needs when considering future water supplies for the region. Unfortunately, as noted in the Region Description, Section B.5.4.c, environmental water needs are not well quantified for the Greater Monterey County IRWM region. The lack of numerical data suggests that environmental water needs may be getting overlooked in water resource planning. Addressing environmental water needs will become more and more critical as ecosystems become increasingly vulnerable to the impacts of climate change. One of the objectives of this IRWM Plan is to “support applied research and monitoring to better understand environmental conditions, environmental water needs, and the impacts of water-related projects on environmental resources.” It is the intention of the RWMG to provide quantified data for environmental water needs in future updates of this IRWM Plan.
- *SVIGSM:* The SVIGSM is a sophisticated modeling tool developed for analysis of hydrologic conditions in the Salinas Valley. Although the SVIGSM was last updated in 1997, it is a powerful model and is still considered the best and most valuable tool for Salinas Valley Groundwater Basin management. Nonetheless, if recalibrated to current conditions, the SVIGSM would be that much more valuable a tool for water resource management planning in the region. The RWMG would like to see this model updated, should funding become available.
- *Future urban water demand:* As described in Section B.5.4.a of the Region Description chapter, future urban water demand in the Salinas Valley has been estimated for the purposes of this IRWM Plan according to three different methods: 1) using GWESRs and AMBAG population data, 2) using projections reported by water purveyors, primarily in their UWMPs, and 3) using SVIGSM. While the timeframe for this IRWM Plan is a minimum 20-year planning horizon (to the year 2035), two of the three methods (projections by water purveyors and SVIGSM) only allow for projections to the year 2030. For future updates of this IRWM Plan, the RWMG will work more closely with water purveyors to obtain water use projections that extend over the minimum 20-year planning horizon, and hopes to see the SVIGSM updated.
- *Climate change impact assessment, adaptation and mitigation:* There are significant data resources that are needed before more accurate vulnerability evaluations can be made. Key data needs that have been identified to date include: 1) a comprehensive coastal elevation map using Light Detection And Ranging (LIDAR) data collected in 2011; 2) a complete inventory of water management infrastructure within the areas identified as vulnerable to the combined impacts of sea level rise and increased rain; 3) an evaluation of future capacity of culverts and tide gates that protect inland wetlands, agriculture, and urban land uses under various sea level rise scenarios; and 4) a cost benefit/effectiveness analysis of coastal protection, adaptation, and retreat options for various categories of coastal infrastructure and land uses.

Note that all of the data and information contained in this IRWM Plan will be reviewed and updated approximately every five years, depending on available funds, as part of the formal IRWM Plan update. Some data will be reviewed on a more frequent basis; for example, MHI data will be reviewed prior to every Proposition 84 Implementation Grant solicitation, using the ACS five-year survey estimates, in order to determine the status of DACs in the region.