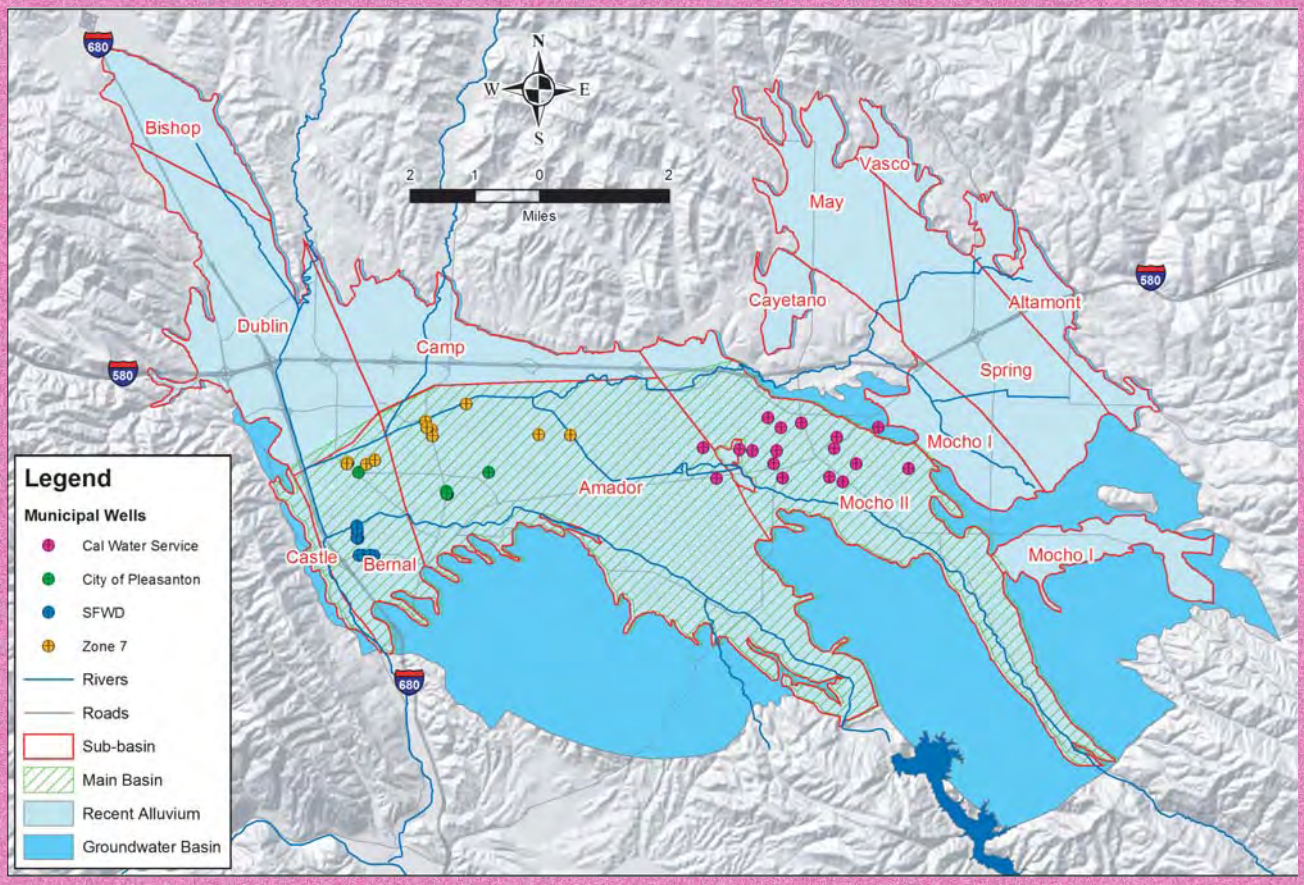
Annual Report for the
Groundwater Management Program
2010 Water Year

Livermore Valley Groundwater Basin



June 2011

Zone 7 Water Agency

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Acronyms and Abbreviations

µg/L	Micro grams per liter
ACEH	Alameda County Environmental Health
ACWA	Association of California Water Agencies
AF	Acre-feet
AF/yr	Acre-feet per year
bgs	Below ground surface
BMOs	Basin management objectives
BTEX	Benzene, toluene, ethylbenzene, xylene
CDFG	California Department of Fish and Game
CDPH	California Department of Health Services
COL	Chain of Lakes
CEQA	California Environmental Quality Act
cfs	Cubic feet per second
CWS	California Water Service
DSRSD	Dublin San Ramon Services District
DVWTP	Del Valle Water Treatment Plant
DWR	California Department of Water Resources
EC	Electrical Conductivity
EBDA	East Bay Dischargers Authority
EIR	Environmental Impact Report
ft	Feet
GAC	Granulated Activated Carbon
GIS	Geographic information systems
GWMP	Groundwater Management Plan
GPQ	Groundwater Pumping Quota
HET	High-Efficiency Toilet
HI	Hydrologic Inventory
LAVWMA	Livermore-Amador Valley Water Management Agency
LOP	Local Oversight Program
LWRP	Livermore Water Reclamation Plant
M&I	Municipal and Industrial
MCL	Maximum contaminant level
mg/L	Milligrams per liter
MND	Mitigated negative declaration
MTBE	Methyl tertiary-butyl ether
NGE	Nodal Groundwater Elevation
NPDES	National Pollutant Discharge Elimination System
PCE	Tetrachlorethylene
ppb	Parts per billion
PPWTP	Patterson Pass Water Treatment Plant
RO	Reverse osmosis

1 Introduction

In 2005, the Zone 7 Water Agency (Zone 7) adopted a Groundwater Management Plan (GWMP) that compiled all of Zone 7's current groundwater management policies and programs into a single document and satisfied the requirements set forth in the California Groundwater Management Planning Act (Section 10750 et seq. of the Water Code). The GWMP provides a detailed description of Zone 7's groundwater management practices, basin management objectives (BMOs), and stakeholder involvement. A large portion of the GWMP also addresses monitoring programs and protocols related to groundwater and conjunctive use of regional water supplies. The purpose of the GWMP is to document all of Zone 7's existing programs and policies that together serve as the basis for successfully managing groundwater resources and to develop a framework for considering future amendments to policy and procedures collaboratively with other basin users such as the Tri-Valley Retail Group and its member agencies, Dublin San Ramon Services District (DSRSD), California Water Service (CWS), the City of Pleasanton and the City of Livermore. The GWMP, which will be updated by May 2014, is available online at: http://www.zone7water.com/index.php?option=com_content&task=view&id=79&Itemid=550)

This Annual Report for the Groundwater Management Program, a companion to the GWMP, summarizes the status of Zone 7's groundwater management program for the 2010 Water Year (October 2009 to September 2010). This report includes 2010 Water Year data sets, results, and interpretations for the monitoring, evaluation, and management programs outlined in the GWMP. In addition, the programs are reviewed in this effort to verify that their elements are still meeting the overall goal of the GWMP. This annual report includes the following sections:

- **Section 2: Background** – provides an overview of the hydrogeologic setting.
- **Section 3: Monitoring Programs** – provides a brief overview of Zone 7's monitoring programs and presents monitoring results for the 2010 Water Year.
- **Section 4: Basin Evaluation Programs** – describes how the monitoring program results were analyzed to provide an understanding of 2010 Water Year basin conditions, including calculations for recharge, groundwater storage, and salt loading.
- **Section 5: Basin Management** – describes how Zone 7 managed the basin for 2010 including descriptions of groundwater sustainability, salt management, groundwater resource protection programs, and capital projects that pertain to groundwater management.
- **Section 6: Reference** – a list of reports or documents that were used to prepare this report.

Tables and figures referenced in the sections can be found in the ‘Tables’ and ‘Figures’ sections at the end of the report.

2 Background

2.1 Overview

Zone 7 has actively managed the Livermore Valley Groundwater Basin (California Department of Water Resources [DWR] Basin No. 2-10; a.k.a., Livermore-Amador Valley Groundwater Basin) for over 40 years. Zone 7 manages both surface and groundwater supplies for conjunctive use and reliability of water supplies. Groundwater typically makes up 15-25% of the water supplied by Zone 7 to its retail water supply agencies. In addition, two of the four retailers independently operate supply wells, as do other domestic and agricultural users, so total groundwater makes up a higher percentage of the total regional supply (typically 20-40%).

Management of a groundwater basin requires multiple programs to assess the state of the groundwater basin and achieve successful management goals and objectives. Zone 7 has developed numerous interrelated policies and programs to assess, manage, monitor, and protect the groundwater supply. In 2005, Zone 7 compiled and documented its groundwater management policies, objectives, and programs in its GWMP for the Livermore Valley Groundwater Basin. The GWMP provides a detailed description of Zone 7's groundwater management practices throughout the Livermore Valley Groundwater Basin and provides a description of the regulatory setting that is relevant to a GWMP. In addition, the GWMP contains the Zone 7 management plan elements, which involve the GWMP goals, Basin Management Objectives (BMOs), and documentation of stakeholder involvement in developing those practices. A large portion of the GWMP addresses monitoring programs and protocols related to groundwater and conjunctive use of regional water supplies.

The programs listed below, and described in detail in the GWMP, represent the ongoing efforts by Zone 7 to achieve its BMOs**.** Programs are administered for the Water Year (WY, October through September) and/or Calendar Year (CY, January through December) as indicated below:

Monitoring Programs (described in Section 3)

- Climatological Monitoring Program (WY)
- Groundwater Elevation and Quality Monitoring Program (WY)
- Surface Water Flow and Quality Monitoring Program (WY)
- Subsidence Monitoring Program (WY)
- Mining Area Monitoring Program (WY)
- Land Use Monitoring Program (WY)
- Groundwater Production Monitoring Program (WY and CY)
- Wastewater and Recycled Water Monitoring Program (WY and CY)

Basin Evaluation Programs (described in Section 4)

- Recharge Calculations (WY)
- Groundwater Storage (WY)
- Salt Loading (WY)
- Groundwater Modeling (WY and CY)

Basin Management (described in Section 5)

- Supply and Demand Management (CY)
- Salt Management (WY and CY)
- Groundwater Resource Protection (CY)
- Capital Projects (CY)

The GWMP itself is intended to be a 'living document' and as such, will undergo periodic reevaluations and updates as conditions and management goals may change. Any such future changes to the GWMP will involve a collaborative effort between Zone 7, the California Regional Water Quality Control Board (RWQCB), Zone 7's retailers, and other stakeholders in an open public process.

2.2 Hydrogeology

2.2.1 Overview

The Livermore-Amador Valley (Valley), an east-west trending, inland alluvial basin located in northeastern Alameda County, is surrounded primarily by north-south trending faults and hills of the Diablo Range. The Valley covers about 42,000 acres, extends approximately 14 miles in an east-west direction, and varies from three to six miles in width. The Livermore Valley Groundwater Basin is located in the heart of the Valley and extends south into the hills south of Pleasanton and Livermore. The Main Basin (shown on Figure 2.2-1) is a portion of the Livermore Valley Groundwater Basin that contains the highest yielding aquifers and best quality groundwater. The geology of the Valley is described in detail in the GWMP and is summarized below.

2.2.2 Geology

The Valley is partially filled with recent alluvial fan, stream and lake deposits (of Pleistocene-Holocene age; less than about 1.6 million years old) that range in thickness from a few feet along the margins to nearly 800 feet (ft) in the west-central portion. The alluvium consists of unconsolidated gravel, sand, silt, and clay. The southeastern region of the Valley is the most important groundwater recharge area and consists mainly of sand and gravel that was deposited by the ancestral and present Arroyo Valle and Arroyo Mocho.

The Livermore Formation (Pleistocene age; 11,000 to 1.6 million years old), found below the majority of the alluvium in the groundwater basin, consists of beds of clayey gravels and sands, silts, and clays that are unconsolidated to semi-consolidated. This formation is estimated to be 4,000 ft thick in the southern and western portion of the basin. These sediments display lower yields in the upland areas.

The Tassajara and Green Valley Formations, located in the Tassajara Uplands north of the Valley, are roughly Pliocene in age (1.6 to 5.3 million years old). They basically consist of sandstone, tuffaceous sandstone/siltstone, conglomerate, shale, and limestone. Water movement from these formations to the alluvium of the fringe and Main Basins is minimized by faults and angular unconformities or by stratigraphic disconformities along the formation-alluvium contacts.

2.2.3 Main Basin

The Main Basin is comprised of the Castle, Bernal, Amador and Mocho II Subbasins (shown on Figure 2.2-1) and is bounded on the:

- North by the Parks Boundary which separates the Dublin and Camp Subbasins of the fringe basin from the Bernal and Amador Subbasins. This boundary was initially considered to be fault-related, but may be a depositional boundary between recent alluvium and older material;
- East by shallow bedrock separating the Mocho I and Mocho II Subbasins;
- South by the tilted Livermore Formation in the Livermore Uplands; and
- West by Pleasanton Ridge, the Dublin Uplands, and the Calaveras Fault.

The majority of the connectivity between the fringe areas and the Main Basin is through shallow alluvium. Subsurface inflow into the deeper portions of the Main Basin from the fringe subbasins is considered to be minor. The deeper aquifers are primarily recharged through vertical migration of groundwater within the Main Basin.

2.2.4 Aquifer Zones

Although multiple aquifers have been identified in the Main Basin alluvium, wells have been classified generally as being in one of two aquifer zones, separated by a relatively continuous silty clay aquitard up to about 50 ft thick:

Upper Aquifer Zone - The upper aquifer zone consists of alluvial materials, including primarily sandy gravel and sandy clayey gravels. These gravels are usually encountered underneath the surficial clays typically 5 to 70 ft below ground surface [bgs] in the west and exposed at the surface in the east. The overburden thicknesses are contoured on Figure 2.2-2. The base of the upper aquifer zone is at about 80 to 150 ft bgs. Groundwater in this zone is generally unconfined; however when water levels are high, portions of the Upper Aquifer Zone in the western portion of the Main Basin can become confined.

Lower Aquifer Zone - All sediments encountered below the clay aquitard in the center portion of the basin have been known collectively as the Lower Aquifer Zone. The aquifer materials consist of semi-confined to confined, coarse-grained, water-bearing units interbedded with relatively low permeability, fine-grained units. It is believed that the Lower Aquifer Zone derives most of its water from the Upper Aquifer Zone through the leaky aquitard(s) when groundwater heads in the upper zone are greater than those in the lower zone.

2.2.5 Historical Lows

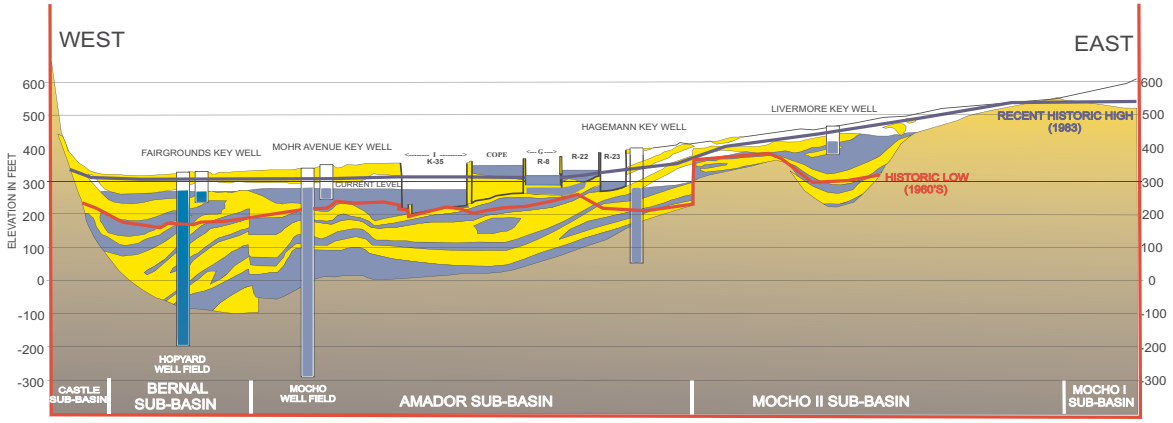
Zone 7 maintains groundwater levels above 'historical lows', a piezometric surface that was created from a compilation of historical-low groundwater elevations in various wells in the basin. These data are typically from the 1960s, 1977, and 1987-1992 drought periods when groundwater elevations were lowest in the basin. This historical low surface corresponds to a groundwater storage volume of about 128,000 acre-feet (AF) . Historical high water levels correspond to storage volume of about 254,000 AF. The range from historical low to historical high provides and operational storage of about 126,000 AF.

In 1987, Zone 7 adopted a Groundwater Management Policy that included maintaining groundwater levels high enough to provide emergency reserves adequate for the worst credible drought. In 2005, Zone 7 adopted mitigation measures for its Well Master Plan (WMP, *Zone 7, 2003*) that require Zone 7 to maintain groundwater elevations above the historical lows, and to reduce the pumping or shift it to wells having higher groundwater elevations when groundwater elevations approach the historical lows to reduce the risk for groundwater pumping-induced subsidence (Mitigation Measures 3.3-1b and 3.3-1c). It should be noted that Zone 7 uses static condition water level data from local monitoring wells rather than pumping level data to gauge the height above the historical lows and compliance with the mitigation measure.

The historical low surface used in the WMP and associated EIR (*Zone 7, 2005b*) was created using data only from wells located in the Bernal and Amador Subbasin. For this work it served as a benchmark for various groundwater modeling scenarios where well pumping was varied in these two subbasins. In 2008 the historical low surface was extended to include the entire Main Basin using additional low water elevations from the Castle and Mocho II Subbasins. In 2009, the historical lows contour map was converted to a surface grid (i.e., *ArcGIS* raster image) for comparison with end-of-water-year elevations and spatial analyses (Figure 2.2-3). Section 3.2.3 discusses the relationship of 2010 water levels to historical lows .

RWQCB	California Regional Water Quality Control Board
SBA	South Bay Aqueduct
SFWD	San Francisco Water District
SMP	Salt Management Plan
SWP	State Water Project
TAF	Thousand acre-feet
TBA	Tertiary-butyl alcohol
TCE	Trichloroethylene
TDS	Total dissolved solids
TPHd	Total petroleum hydrocarbons as diesel
TPHg	Total petroleum hydrocarbons as gasoline
ULFT	Ultra-Low-Flow Toilet
USACOE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WMP	Well Master Plan
WQMP	Water Quality Management Plan
WWMP	Wastewater Management Plan for the Unsewered, Unincorporated Area of Alameda Creek Watershed Above Niles

LIVERMORE VALLEY GROUNDWATER BASIN
WEST-EAST CROSS-SECTION



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