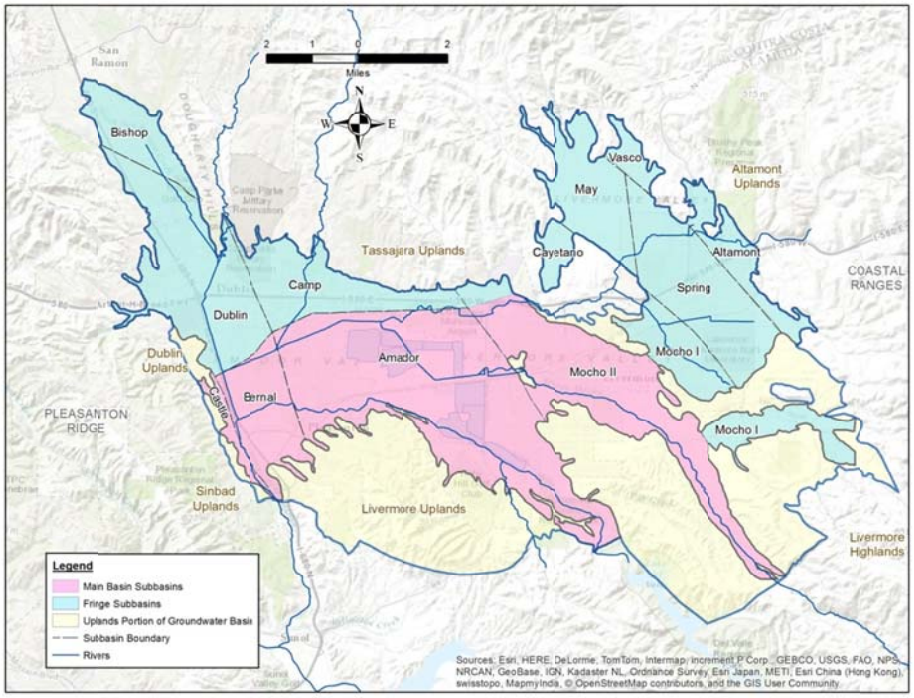
1 Background

1.1 Introduction

This report is the Annual Report for the Groundwater Management Program (GWMP) for the 2014 Water Year (WY, October 1, 2013 through September 30, 2014). Zone 7 adopted its GWMP in 2005 (*Zone 7, 2005a*). The GWMP covers Zone 7's service area with a special emphasis on the Livermore Valley Groundwater Basin located in the center of the service area.

The Livermore Valley Groundwater Basin is an inland alluvial basin underlying the east-west trending Livermore-Amador Valley (Valley) in northeastern Alameda County. 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. It is surrounded primarily by north-south trending faults and hills of the Diablo Range. The Livermore Valley Groundwater Basin is located in the heart of the Valley and extends south into the uplands south of Pleasanton and Livermore. The Main Basin (shown below in *Figure 1-A*) is a portion of the Livermore Valley Groundwater Basin that contains the highest yielding aquifers and generally the best quality groundwater. Groundwater flow is generally from southeast and east to the west, towards the municipal wellfields in the West Amador and Bernal Subbasins.

Figure 1-A: Map of Livermore Valley Groundwater Basin



1.2 Groundwater Management Plan Elements

Figure 1-B shows Groundwater Management Planning Act requirements, where each was addressed in the original 2005 GWMP, and where the updated information, if any, can be located in the Annual Report for the 2014 WY.

Figure 1-B: Groundwater Management Planning Act Requirements

Water Code Reference	Requirement	Location in 2005 GMP	Location of update in 2014 Water Year Annual Report
§10753.7(a)(3)	Description of groundwater area to be managed		
	Map	*Figures 1-1* and *2-1*	*Figure ES-1* and *Figure 1-A*
	Description	Overview located in Chapter 1; also see Section 3.1.1.	Section 1.4
§10753.7(a)(1)	Basin Management Objectives	Included in Section 1.4	Section 1.3
§10753.7(a)(2)	Plan to involve other agencies and the public	Included in Section 4.3	No update
§10753.7(a)(4)	Monitoring protocols	Sections 3.2, 3.3, and 4.5	Sections 2 through 9
§10753.8	Plan components		
	Control of saline water intrusion	Sections 4.6.5 and 5.1.2	Section 12.1
	Identification and management of wellhead protection areas and recharge areas	Sections 3.3, 5.1.4.2, and 5.1.4.4	Sections 10.3.2, 12.5, and 12.6
	Regulation of the migration of contaminated groundwater	Sections 3.5 and 5.1.4.5	Sections 6 and 12.6
	Administration of a well abandonment and well destruction program	Section 5.1.4.2	Section 12.5
	Mitigation of conditions of overdraft	Sections 3.2, 3.3, 4.6.2, and 4.6.3	Sections 5 and 10.3
	Replenishment of groundwater extracted by water producers	Sections 3.3, 4.5.7, 4.6.2, and 4.6.3	Sections 10.3 and 11.2
	Monitoring of groundwater levels and storage	Section 4.5.2	Sections 5 and 10.1
	Facilitating conjunctive use	Section 5.1.3	Section 11.3.2

Water Code Reference	Requirement	Location in 2005 GMP	Location of update in 2014 Water Year Annual Report
	operations		
	Identification of well construction policies	Section 5.1.4.2	Section 12.5
	Construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling and extraction projects	Section 5.1.4	Section 12
	Development of relationships with state and federal regulatory agencies	Section 4.4	No update
	Review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination	Section 4.5	Section 9
§10753.2	Details of Public Hearing(s) and Plan Adoption	Section 5.3	No update

1.3 Groundwater Management Objectives

The primary groundwater Basin Management Objectives (BMOs) of Zone 7 are to provide for the control and conservation of waters for beneficial future uses, the conjunctive use of groundwater and surface water, the importation of additional surface water, and the use of the groundwater basin to provide water storage for imported surface water used during drought periods.

The primary BMOs implemented by Zone 7 include:

- Monitor and maintain groundwater levels through conjunctive use and management of regional water supplies:
  - maintain water levels high enough to provide adequate supply during worst credible drought and surface water facility outages;
  - optimize groundwater levels to allow for gravel mining while maintaining adequate reserves for municipal supply; and
  - prevent long-term overdraft of groundwater supplies (maintain annual average pumping at or below sustainable/safe yields).

- Monitor and manage groundwater quality, as well as track and address any groundwater quality degradation:
  - maintain or improve groundwater quality to achieve Regional Water Quality Control Board's (RWQCB) Basin Plan Objectives for groundwater (*California Regional Water Quality Control Board, San Francisco Bay Region [amended in March 2015]*);
  - halt or offset degradation of salt and mineral buildup from water recycling and wastewater disposal through integrated Salt Management Plan (SMP);
  - recharge with relatively low total dissolved solids (TDS)/hardness imported or storm/local surface water;
  - manage quality on a regional basis as measured at municipal wells (such as those operated by both the retail water agencies and Zone 7), protecting and improving groundwater quality within the Main Basin (as described in *Section 12*); and
  - minimize threats of groundwater pollution through groundwater protection.

- Prevent inelastic land surface subsidence from occurring as a result of groundwater withdrawals:
  - maintain groundwater levels above historical lows; and
  - monitor benchmark elevations and shift pumping to other wells if inelastic subsidence is detected.

1.4 Hydrogeologic Setting

This section provides a brief summary of the hydrogeologic setting of the Livermore Valley Groundwater Basin. A more detailed description can be found in Zone 7's Groundwater Management Plan (*Zone 7, 2005a*).

1.4.1 Geology

The Valley and portions of the surrounding uplands overlie groundwater-bearing materials. These materials consist of deposits from alluvial fans, streams, and lakes (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 (*Figure 1-1*). 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. However, the contact between the overlying alluvium and the Livermore Formation is nearly impossible to discern from drill cuttings and electrical logs. This formation is estimated to be 4,000 ft thick in the southern and western portion of the basin and yields low quantities of groundwater 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. Faults and angular unconformities or stratigraphic disconformities along the formation-alluvium contacts inhibit groundwater movement from these formations to the alluvium of the fringe and Main Basins.

Other faults and depositional features define subbasin boundaries and in some cases restrict lateral movement of groundwater. These include: the Parks Boundary, as well as the Livermore, Pleasanton, Calaveras, and Greenville faults.

1.4.2 Main Basin and Sub-Basins

The Main Basin is comprised of the Castle, Bernal, Amador and Mocho II Subbasins (shown previously on *Figure 1-A*). It 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 (fringe basin) and Mocho II (Main Basin) Subbasins;

- South by the tilted Livermore Formation in the Livermore Uplands; and

- West by Pleasanton Ridge, the Dublin Uplands, and the Calaveras Fault.

The Main Basin is hydraulically connected to the fringe areas through the shallow alluvium; however, subsurface inflow from the fringe subbasins into the deeper portions of the Main Basin is considered to be minor. The deeper aquifers of the Main Basin are primarily recharged through vertical migration of groundwater within the Main Basin itself. The Main Basin aquifers have the highest transmissivity. All of the Valley's municipal supply wells are completed in Main Basin aquifers.

1.4.3 Aquifer Zones

Although multiple aquifers have been identified in the Main Basin alluvium, wells have been classified generally as being completed in either the Upper or Lower Aquifer Zone. The two zones are separated by a relatively continuous silty clay aquitard, that is up to 50 feet thick and present beneath the Upper Aquifer Zone (80 to 150 feet below ground surface [bgs]).

1.4.3.1 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 a confining surficial clay layer typically 5 to 70 ft bgs in the west and exposed at the surface in the east. The overburden thicknesses have been contoured and are shown on *Figure 1-2* along with the limits of the confining layer and the main recharge area of the Main Basin. The base of the upper aquifer zone varies from 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.

1.4.3.2 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 piezometric heads in the upper zone are greater than those in the lower zone.

1.4.4 Groundwater Characteristics

The northern extent of the Livermore-Amador Valley is dominated by a sodium rich water, while much of the western part of the basin near Pleasanton has a magnesium-sodium characteristic (i.e., both magnesium and sodium are dominant cations). The area along the eastern portion of the basin, beneath the Livermore area, has magnesium as the predominant cation. Most groundwater in the Basin is "hard" or "very hard" (i.e., $CaCO_3$ greater than 120 milligrams per liter [mg/L]), however, groundwater tends to be the hardest in the west. Groundwater of the Lower Aquifer zones are generally of better quality than the Upper Aquifer zone groundwater; however, both aquifer zones are designated for potable use.