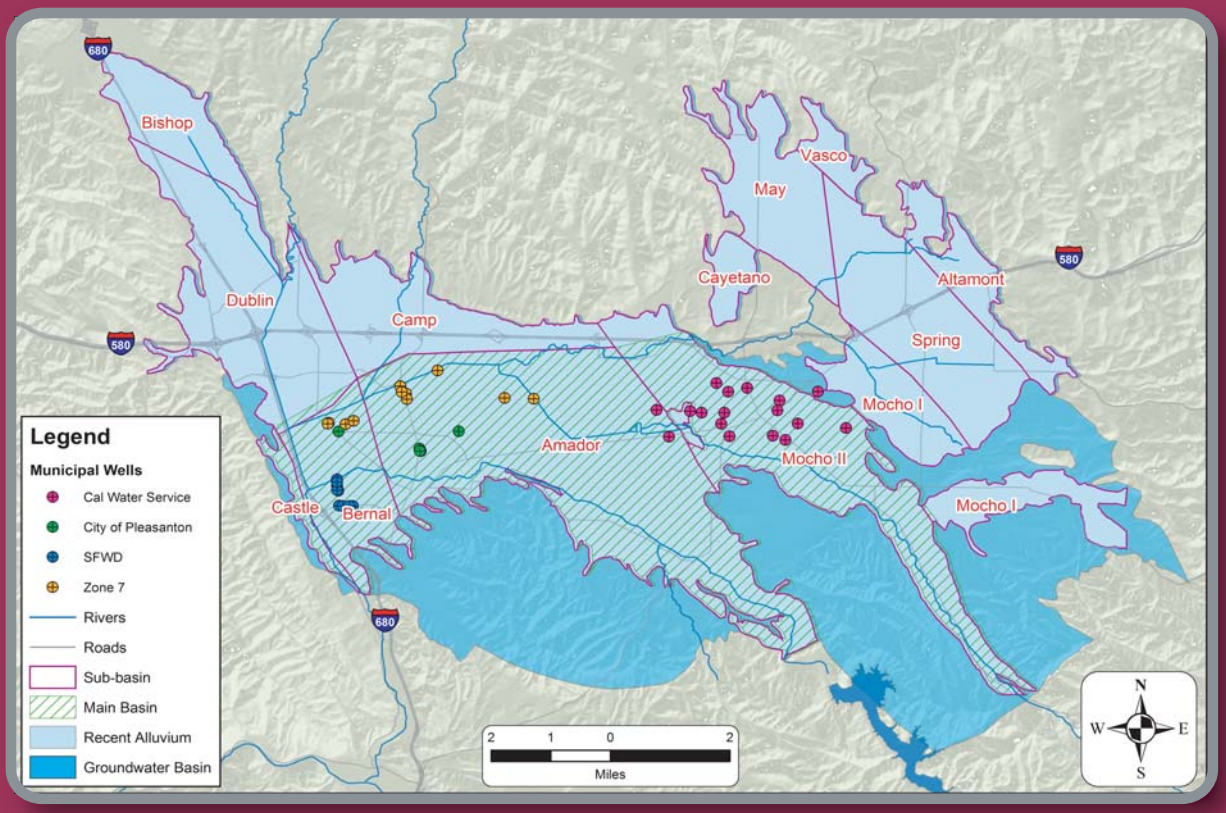
Annual Report for the
Groundwater Management Program
2012 Water Year

Livermore Valley Groundwater Basin



May 2013

Zone 7 Water Agency

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Groundwater Management Program

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Livermore Valley Groundwater Basin

ZONE 7 WATER AGENCY

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Acronyms and Abbreviations

µg/L	Micro grams per liter
ACEH	Alameda County Environmental Health
ACWD	Alameda County Water District
ADLLV	Arroyo De La Laguna at Verona
ADVP	Arroyo Del Valle Pleasanton
ALP	Arroyo Las Positas
ALP_ELCH	Arroyo Las Positas at El Charro
ALPL	Arroyo Las Positas near Livermore
AMHAG	Arroyo Mocho Hageman
AM_KB	Arroyo Mocho at Kaiser Bridge
AMNL	Arroyo Mocho near Livermore
AMP	Arroyo Mocho Pleasanton
AVBLC	Arroyo Valle below Lang Canyon
AVNL	Arroyo Valle near Livemore
AF	Acre-feet
AF/yr	Acre-feet per year
ALP	Arroyo Las Positas
bgs	Below ground surface
BMOs	Basin management objectives
BTEX	Benzene, toluene, ethylbenzene, xylene
CASGEM	California Statewide Groundwater Elevation Monitoring
CDPH	California Department of Health Services
CEC	Constituents-of-emerging-concern
CIMIS	California Irrigation Management System
COL	Chain of Lakes
CEQA	California Environmental Quality Act
cfs	Cubic feet per second
CIP	Capital Improvement Program
CWS	California Water Service
DCE	Dichloroethene
DSRSD	Dublin San Ramon Services District
DVWTP	Del Valle Water Treatment Plant
DWR	California Department of Water Resources
EBRPD	East Bay Regional Parks District
EIR	Environmental Impact Report
ETo	Evapotranspiration
ft	Feet
GAC	Granulated Activated Carbon
GIS	Geographic information systems
GWMP	Groundwater Management Plan
GPQ	Groundwater Pumping Quota

GPD	Gallons per day
GWE	Groundwater Elevation
HI	Hydrologic Inventory
LAVWMA	Livermore-Amador Valley Water Management Agency
LDV	Lake Del Valle
LOP	Local Oversight Program
LWRP	Livermore Water Reclamation Plant
M&I	Municipal and Industrial
MCL	Maximum contaminant level
mg/L	Milligrams per liter
MGDP	Mocho Groundwater Demineralization Plant
MND	Mitigated negative declaration
MSL	Mean sea level
MTBE	Methyl tertiary-butyl ether
NPDES	National Pollutant Discharge Elimination System
PCE	Tetrachlorethylene
POTW	Publicly owned treatment works
ppb	Parts per billion
PPWTP	Patterson Pass Water Treatment Plant
RO	Reverse osmosis
ROWD	Request of Waste Discharge
RWQCB	California Regional Water Quality Control Board
SBA	South Bay Aqueduct
SCS	Soil Conservation Service
SFPUC	San Francisco Public Utilities Commission
SFEI	San Francisco Estuary Institute
SMP	Salt Management Plan
SNMP	Salt Nutrient Management Plan
SWP	State Water Project
TAF	Thousand acre-feet
TBA	Tertiary-butyl alcohol
TCE	Trichloroethylene
TDS	Total dissolved solids
TKN	Total Kjeldahl nitrogen
TPHd	Total petroleum hydrocarbons as diesel
TPHg	Total petroleum hydrocarbons as gasoline
USGS	U.S. Geological Survey
VA	Veteran's Administration
VC	Vinyl chloride
WMP	Well Master Plan
WWMP	Wastewater Management Plan for the Unsewered, Unincorporated Area of Alameda Creek Watershed Above Niles

1 Introduction

In 2005, the Zone 7 Water Agency (Zone 7) adopted a Groundwater Management Plan (GWMP) that satisfied the requirements of the California Groundwater Management Planning Act (Sections 10750, *et seq*., of the Water Code). The GWMP provides a detailed description of Zone 7's groundwater management programs and practices, Basin Management Objectives (BMOs), and stakeholder involvement. The GWMP is available online at:
http://www.zone7water.com/index.php?option=com_content&task=view&id=79&Itemid=550)

This Annual Report of the Groundwater Management Program serves as a supplement to the GWMP, providing updates to Zone 7's groundwater management program. This report also includes the 2012 Water Year (October 2011 through September 2012) monitoring program data sets, results, and interpretations. The programs are reviewed during this effort to verify that their elements are still meeting the overall goal of the GWMP. This annual report is organized in the following sections:

- **Section1: Introduction**.
- **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 2012 Water Year.
- **Section 4: Basin Evaluation Programs** – provides analyses of the monitoring program results to gain a thorough understanding of 2012 Water Year basin conditions and includes calculations for recharge, groundwater storage, and salt loading.
- **Section 5: Basin Management** – describes how Zone 7 managed the basin during 2012 and includes 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.

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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 50 years. Zone 7 integrates management of 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; however, higher groundwater use can occur during droughts and surface water shut-downs. In addition, two of the four retailers independently operate supply wells, as do other domestic and agricultural users, so the total amount of groundwater makes up a higher percentage of the total regional supply (typically 20-40%).

Successful management of a groundwater basin requires monitoring, assessment, and management goals and objectives. Zone 7 has developed numerous interrelated policies and programs to monitor, assess, manage 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, 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. In effect, this management involves three steps: Data Collection ("Monitoring Programs"), Data Analysis/Findings ("Evaluation Programs"), and Recommendations/Implementation of programs and projects ("Management").

The programs listed below, and described in detail in the GWMP, represent the ongoing efforts by Zone 7 to achieve its BMOs**.** Most programs are administered for the Water Year (WY, October through September); however a few are compiled and reported on a Calendar Year basis (CY, January through December) as indicated below, due to other reporting obligations:

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. Periodic adjustments to the GWMP will be noted in the annual reports, whereas, major revisions will be handled through a formal revision/supplemental process that 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 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 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 generally the best quality groundwater. Groundwater flow is generally from southeast and east to the west, towards the municipal wellfields in the central western area of the basin.

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. 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. 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). 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 connected primarily to the fringe areas through the shallow alluvium. Subsurface inflow into the deeper portions of the Main Basin from the fringe subbasins 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.

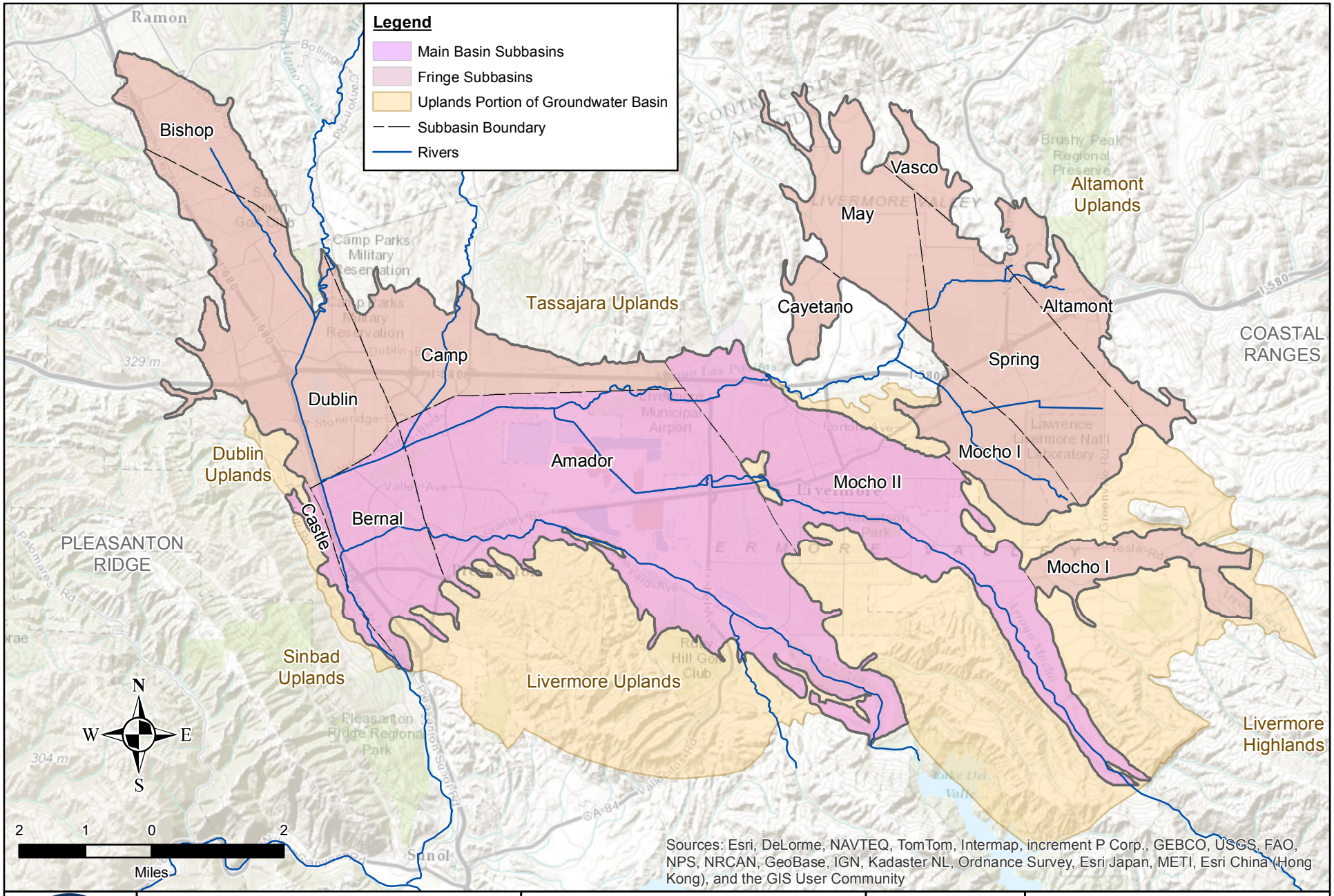
2.2.4 Aquifer Zones

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 a confining surficial clay layer typically 5 to 70 ft below ground surface [bgs] in the west and exposed at the surface in the east. The overburden thicknesses have been contoured and are shown on Figure 2.2-2 along with the

limits of the confining layer. 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.



ZONE 7 WATER AGENCY
100 North Canyons Parkway, Livermore, CA

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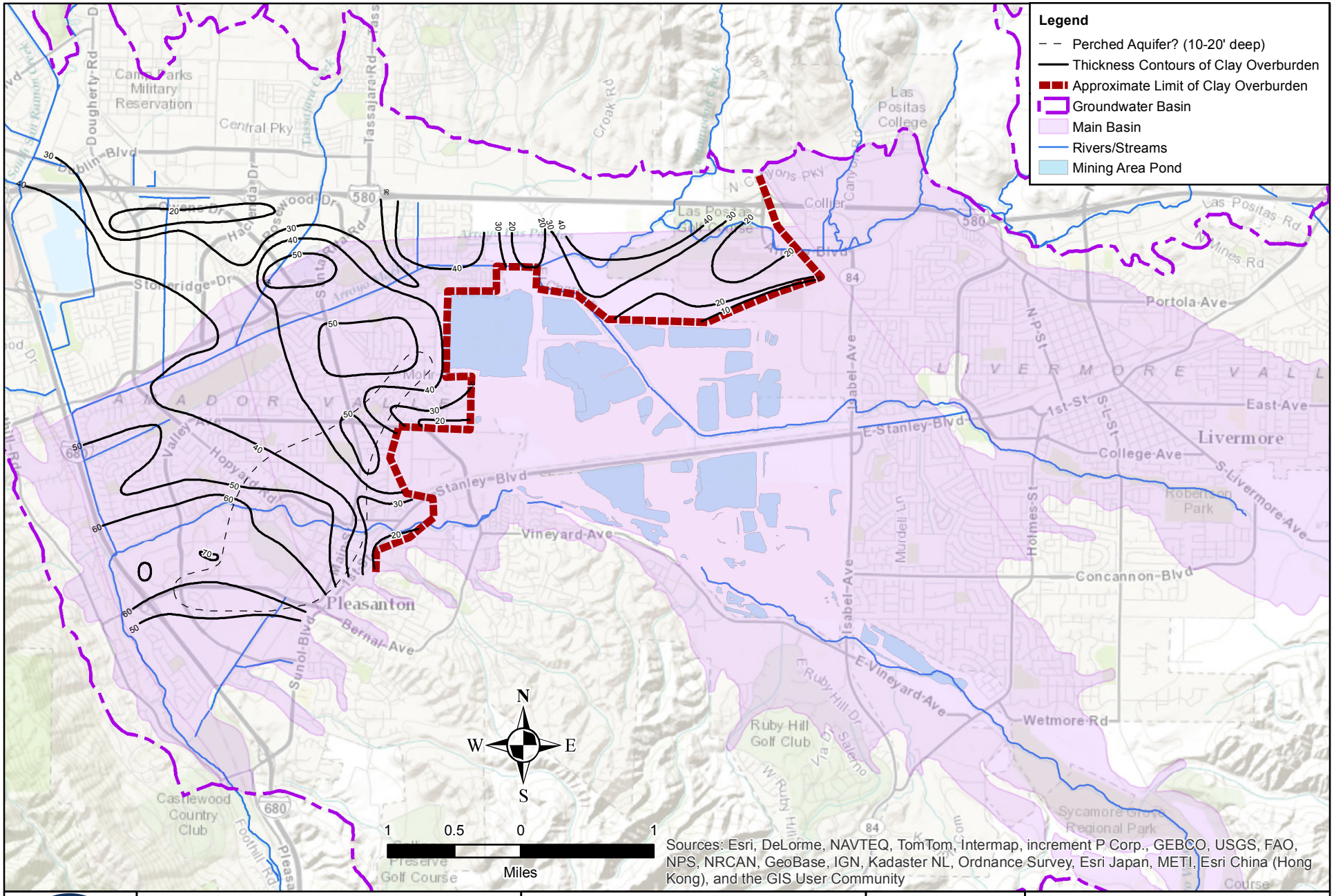
Figure 2.2-1
Groundwater Basin Map



Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

ZONE 7 WATER AGENCY
100 North Canyons Parkway, Livermore, CA

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Figure 2.2-2
Thickness of Clay Overburden Above Upper Aquifer