5 Basin Management

5.1 Groundwater Management and Sustainability

5.1.1 Overview

Zone 7's basin management program attempts to find the best cost-effective way of providing a long-term viable water supply to meet 100% of valley-wide demands during any hydrologic condition while ensuring long-term stable groundwater quality and protection from groundwater basin overdraft. The program is adaptive because it relies on current hydrologic conditions to direct the program towards the best solution for the current water supply, water demand, and water quality conditions. The program includes:

- Calculating the long-term sustainable groundwater yield (Section 5.1.2)
- Limiting groundwater pumping to the sustainable replenishment quantities (Section 5.1.3).
- Importing and banking surface water to meet future demands (Section 5.1.4).
- Implementing a conjunctive use program that utilizes the full storage capacity of the groundwater basin (Section 5.1.5).
- Promoting increased and sound recycled water use (Section 5.1.6).
- Identifying and planning for development plans for future supply and demand impacts (Section 5.1.7).

The details of these program components are described briefly below and in more detail in the GWMP (Zone 7, 2005a).

5.1.2 Natural Sustainable Yield (Safe Yield)

The Main Basin's natural, sustainable, groundwater yield is defined as the amount of water that can annually be pumped from the groundwater basin and replenished by average annual natural recharge. The long-term, natural, sustainable yield, which is calculated based on natural recharge over a century of hydrologic records and projections of future recharge conditions, consists of the following components (described in Sections 4.1 and 4.2):

- Natural Stream Recharge including Arroyo Valle Prior Rights
- Rainfall Recharge
- Applied Water Recharge
- Subsurface Inflow
- Basin Overflow

The long-term, natural, sustainable yield in the Main Basin has been estimated to be about 13,400 AF annually (Zone 7, 1992). Additional water can be and is pumped from the Main Basin each year as long as Zone 7 artificially recharges the basin with additional water from other sources.

While the natural sustainable yield represents long-term-average natural recharge, the actual amount of natural recharge varies from year to year depending on the amount of local precipitation during the year. For the 2011 Water Year, the natural recharge was about 20,507 AF, approximately 153% of normal (Table 4.2-4).

The natural sustainable yield supplies the following demand components, which Zone 7 monitors to make sure they are within the acceptable range:

Table: Sustainable Yield Demand Components (Water Year)

DEMAND COMPONENT	SUSTAINABLE DEMANDS (AF/Yr)	2011 WY (AF)
Municipal pumping by Zone 7 retailers	7,214*	6,778
Other groundwater pumping (SFWD for Castlewood, County Fairgrounds, golf courses, and domestic supply)	1,186	1,058
Agricultural pumping	400	93
Mining area evaporation	3,200	1,905
Gravel mining operations	1,400	4,977
TOTAL WATER YEAR	**13,400**	**14,786**

*Retailer Pumping Quota for a Calendar Year (see Section 5.1.3.1)

For 2011 Water Year the estimated total for these demand components was 14,786 AF; approximately 1,386 AF above the long-term sustainable yield of 13,400 AF. The largest contributor to this single-year exceedance was the stream export component of gravel mining dewatering operations.

The mining activity demands (losses) vary over time depending on the stage of mining in any given pit. When the permitted gravel extraction is complete (estimated for 2030), the decrease in groundwater losses associated with the mining activities (i.e. pit dewatering, gravel washing, and moisture export) should reduce or eliminate this potential overdraft condition. For the near-term, Zone 7 staff is currently working with the gravel mining company staff to investigate ways for the water generated by their pit dewatering operations to be re-percolated into the basin rather than being lost to basin outflow as it is today.

The revised areal recharge spreadsheet model (Section 4.1), which could only run from 1998 to 2011 with the land use data currently available to staff, significantly revised the rainfall and applied recharge volumes. In 2012, Zone 7 will continue to define and evaluate the new model and other recharge components.

5.1.3 Municipal Pumping

5.1.3.1 Pumping by Zone 7 Retailers

As a condition to the water supply contracts and conditions of use that Zone 7 has with its retailers, each retailer is limited to an annual "Groundwater Pumping Quota" (GPQ), which is generally based on average historical uses and is part of the basin sustainable yield. The retailers are permitted to pump a combined 7,245 AF annually with no charge from Zone 7. However, they must pay a "recharge fee" for all groundwater pumped exceeding their quota, for which Zone 7 must provide additional artificial recharge to balance the excess pumping. This practice helps prevent over-drafting of the basin by the large municipal users.

During the 2011 Calendar Year, the retailers pumped just below their collective GPQ. The table below shows the individual GPQs and the amounts pumped in 2011 for each retailer. The carry-over amount will be added to the retailers' GPQ for the following year.

Table: Retailer GPQs Volumes (Calendar Year)

Retailer	GPQ	Carry-over from 2010	Pumped in 2011	Carry-over to 2012
City of Pleasanton*	3,500	668	3,503	665
Cal Water Service*	3,069	0	2,816	253
DSRSD*	645	0	645 (by Zone 7)	0
City of Livermore (currently not used)	31	0	0	0
Normal Total/ Quota (sum of *)	**7,214**	**668**	**6,964**	**918**

5.1.3.2 Zone 7 Pumping

Figure 5.1-1 shows historical Valley water production from groundwater and imported water. Zone 7's annual groundwater pumping historically has varied with the availability of surface water and its capacity to treat that surface water. In general, Zone 7 operates its wells for demand peaks and whenever a shortage or interruption occurs in its surface water supply or treatment. However, Zone 7 has also pumped groundwater as an interim salt management strategy. The decision of which well(s) to pump first is based on pumping costs and customer requests based on aesthetic water quality issues. Although reduced groundwater pumping can have a positive impact on groundwater storage and delivered water quality, increased groundwater pumping has a positive impact on the salt mass loading because much of the salt in the groundwater pumped from the wells eventually leaves the basin as wastewater export.

The following summarizes Zone 7's groundwater production for the 2011 Calendar Year:

- Zone 7 pumped 5,585 AF of groundwater, of which 485 AF was MGDP brine export and 645 AF was for DSRSD's GPQ by agreement, leaving 4,455 AF for Zone 7 potable water demand. This groundwater production represents 12% of Zone 7's total treated water demand for 2011.

- Zone 7 pumped 5,226 AF from the Amador Subbasin and 359 AF from the Bernal Subbasin.

- Most of the Amador Subbasin pumping came from the Mocho wellfield (4,235 AF); whereas 629 AF was pumped from the COL wellfield and 362 AF was pumped from the Stoneridge wellfield. All of Zone 7's Bernal groundwater production (359 AF) came from the Hopyard Wellfield.

- It is anticipated that groundwater production from the Mocho Wellfield will continue to be first in priority because of its connection with MGDP.

5.1.4 Supplemental Water Sources

Zone 7 ensures that the groundwater supplies are not depleted by importing most of the Valley's water supply (approximately 75%) and by recharging the Main Basin with imported or Lake Del Valle water. In addition to the Livermore Valley Groundwater Basin, Zone 7's main sources of water supply are:

- **Arroyo Valle Prior Rights (Lake Del Valle)** – Zone 7 has pending rights to a portion of the natural flows into Lake Del Valle. Accordingly, Zone 7 coordinates releases from the reservoir into the Arroyo Valle to maintain flows and recharge through the streambed at the levels that would have occurred had the reservoir not been constructed. These releases are a requirement of Zone 7's water rights for the Arroyo Valle water and give Zone 7 the ability to use another portion of Arroyo Valle water for supply to its treatment plants.

- **State Water Project (via South Bay Aqueduct)** - As a SWP contractor, Zone 7 imports supplies from the SWP using the SWP conveyance system. As of 1998, Zone 7 has an annual maximum SWP contract amount of 80,619 AF per year (AF/yr) referred to as the "Table A Contract Amount". However, actual SWP deliveries can be and have been less, due to hydrologic conditions. Currently, the long-term reliable yield is 60% of the Table A amount (48,370 AF/yr). This may increase if a "Delta Fix" is implemented sometime in the future.

- **Byron-Bethany Irrigation District (via South Bay Aqueduct) (BBID)** - Zone 7 has a contract with Byron-Bethany Irrigation District for up to an additional 5,000 AF/yr of supplemental water made available as a transfer of pre-1913 Delta water.

- **Kern Groundwater Basin (storage rights only)** - Zone 7 has purchased water storage rights (78,000 AF) in the Semitropic Water Storage District and 120,000 AF of storage in Cawelo Water Storage District groundwater basins in Kern County. The rights give Zone 7 the ability to store surplus SWP water when available and then import those supplies through exchange with DWR when they are needed locally.

Figure 5.1-2 shows the volumes for each of the main water supply and use components for the 2011 Calendar Year. Highlights of activities for 2011 included the following:

- Zone 7 carried-over approximately 8,000 AF of local water in Lake Del Valle for use in 2011,
- Zone 7 imported 36,700 AF of SWP water into the Valley (including 666 from BBID). For the 2011 Calendar Year, total DWR allocations to Zone 7 were 80% of Zone 7's Table A Contract Amount.
- Zone 7 released about 7,100 AF to the local arroyos for its artificial recharge program and to maintain a live-flowing stream on the Arroyo Valle to meet water rights permit conditions.
- Zone 7 increased its total water storage in out-of-basin groundwater banks to about 101,000 AF (Semitropic at 86,000 AF and Cawelo at 15,000 AF).

5.1.5 Conjunctive Use Program

Zone 7 actively embraces a conjunctive use approach to Basin Management by integrating management of local and imported surface water supplies with the management of the local groundwater basin. A key component of Zone 7's integrated conjunctive use approach has been artificial recharge which utilizes releases of surface water to dry arroyos that subsequently recharge the groundwater basin. The location and timing of artificial recharge can be used as a water quality management tool as outlined in the Salt Management Plan as well as a temporal water storage activity. The timing and quantity of artificial recharge are typically dependent upon available supply, natural flows, source water quality, and regulatory requirements.

Zone 7 has caused the Main Basin's water levels to rise and be maintained above the historical lows by artificially recharging more water than it has pumped, and by importing most of the water needed by the Valley's growing population.

Also, when practical, Zone 7 prioritizes its SWP releases for recharge in the spring when TDS is low. Each acre-foot that is subsequently pumped removes water with higher TDS. This exchange process can eventually improve the salinity of the groundwater basin. The salt removal effectiveness is related to the difference in the TDS of recharge and pumped water and the annual volume of water conjunctively used.

For 2011 Zone 7's Conjunctive Use Program included the following activities and highlights:

- Zone 7 released 7,098 AF of water for artificial recharge in 2011 (Calendar Year) while pumping 5,448 AF of water from the Main Basin.
- Zone 7 allowed East Bay Regional Parks District (EBRPD) to divert a total of 400 AF into Shadow Cliffs for recharge and maintaining the lake level.
- From the end of the 2010 Water Year to the end of the 2011 Water Year, total Main Basin operational storage rose about 4,900 AF to 107,000 AF (Section 4.2).

Looking into the future, Zone 7 is planning to increase its conjunctive use to keep up with growing future demands. Groundwater pumping in normal years will increase to about 10,000 AF per year after the completion of the Arroyo Mocho diversion into the Chain of Lakes to supplement Zone 7's artificial recharge capacity.

5.1.6 Municipal Wastewater and Recycled Water Use

Wastewater disposal concerns have been greatly reduced in the valley through the implementation of municipal wastewater treatment and export projects and the restriction of high-density unsewered development over the Main Basin in the 1970's and early 1980's. In the late 1980's and early 1990's, Zone 7 partnered with the cities, wastewater agencies, and the permitting agency (RWQCB) to develop a master water recycling permit. The permit goals were essentially to maximize the beneficial use of recycled water while protecting the groundwater basin from possible water quality degradation. Proper management of local resources require that wastewater disposal and recycled water use be monitored to determine the quantity, the quality, and the impact on the local resources. The City of Livermore and DSRSD are responsible for treating and monitoring the majority of wastewater and all recycled water used within the Valley. Zone 7 reviews their monitoring program data (Section 3.8.2) and evaluates potential impacts of recycled water on the local groundwater resources.

Onsite disposal of wastewater from domestic, commercial and industrial sites, if disposed in natural waterways or if disposed on the land, can have an impact on groundwater quality. However the risk for negative groundwater impacts is greatly reduced when the wastewater has gone through a water reclamation or recycling process prior to its application. Zone 7 views recycled water as a valuable water resource that should be managed appropriately. From a groundwater water supply perspective, recycled water contributes to the stored volume when incidental percolation occurs during irrigation of landscapes and crops. However, in 2011 it accounted for approximately 192 AF or less than 0.8% of the Main Basin's groundwater supply component (i.e., recharging waters). The bigger advantage in 2011 was that it may have conserved up to 3,900 AF of groundwater storage, assuming that the irrigation demand would have been met with groundwater supplies.

From a groundwater quality perspective, recycled water use can add salts and nutrients to the stored groundwater just as onsite wastewater disposal can. About 785 tons of salt or about 5% of the total salt inflow to the Main Basin was attributed to the almost 1,100 AF of recycled water and wastewater applied over the Main Basin in the 2011 Water Year. However, if potable water supplies would have been used for this irrigation demand, the salt loading would have been only 459 tons less. By comparison Zone 7's groundwater demineralization plant (MGDP) removed over 2,000 tons of salt in 2011 while being run at about 1/3 of its capacity.

Both, Livermore and DSRSD plan to expand the use of recycled water for turf and landscape irrigation projects over the next few years. Similarly, Pleasanton is studying the feasibility of importing recycled water from DSRSD for irrigation of city parks and landscapes located over the Main Basin. Although recycled water is currently only a minor contributor to the salt accumulation in the Main Basin, the average TDS concentration of the applied recycled water tends to be over twice the average TDS

concentration of the fresh water served by Zone 7. Therefore, the expansion of recycled water should be carefully planned to minimize the direct impact to the Main Basin's salt loading.

Mitigation of the water quality concerns related to salt loading from recycled water use is addressed in Zone 7's Salt Management Plan (*Zone 7, 2004*) (Section 5.2.1). This plan is currently being updated to conform to the State Water Board's new Recycled Water Policy (*State Water Board, Resolution No. 2009-0011, adopted February 2009*) which calls for the addition of nutrient management planning and emerging constituents-of-concern monitoring to the overall plan. In the process, Zone 7 is collaborating with Livermore, DSRSD, and Pleasanton to incorporate future planned recycled water use expansions, and to identify strategies for limiting the impact to groundwater and delivered water quality. The updated Salt Nutrient Management Plan is scheduled for completion by May 2014.

5.1.7 Review of Development Plans and Land Use Changes

Zone 7 reviews new development plans and their associated CEQA documentation to evaluate their potential impact to groundwater supply and quality. The potential supply impacts can be from new or increased pumping/losses or from a reduction in the Main Basin's recharge capacity. No potentially significant impacts to the groundwater supply or quality were identified during Zone 7's project review efforts in 2011. However, additional evaporative losses and groundwater exportation are anticipated as gravel mining progresses in the future Lakes C and D areas, south of Stanley Boulevard. Zone 7 is managing groundwater levels in the vicinity of the gravel quarries to minimize groundwater exports by the mining companies. Quarry pond evaporation has been incorporated into long-range plans. See Section 5.4.1 for additional information on these plans.

5.2 Salt Management

5.2.1 Strategy and Overview

Zone 7's Water Supply Operations Plans can use an adaptive management approach to selecting the combination of salt management strategies to be implemented in a given year. Multiple variables are balanced when making decisions, and variables change from year to year; hence the need for a so-called adaptive or iterative management approach.

In 2004 Zone 7 prepared a Salt Management Plan (SMP, Section 5.2.2) to address the increasing level of total salts in the Main Basin. This plan led to the construction of Zone 7's groundwater demineralization facility (MGDP), which was completed in July 2009 (Section 5.2.3). The MGDP is designed to decrease or halt the build-up of salts in the groundwater basin without having to deliver the salts to Zone 7's customers. Zone 7 plans to update the Salt Management Plan by May 2014 to conform to the State Water Board's new recycled water policy (*State Water Board, Resolution No. 2009-0011*), and to verify that the original plan's strategy is still appropriate (and sustainable) for managing the future salt loading projected from the updated water supply plans.

5.2.2 Salt Management Plan

Zone 7's SMP was designed to protect the long-term water quality of the Main Basin and was added at Zone 7's request as a requirement of the Master Water Recycling Permit, RWQCB Order No. 93-159, issued jointly to Zone 7, the City of Livermore, and Dublin San Ramon Services District. In May 2004, Zone 7, in cooperation with the other agencies, published its SMP to address the increasing level of salt in the Main Basin. The SMP was approved by the RWQCB in October 2004. The SMP was incorporated into Zone 7's GWMP in 2005.

The SMP identified potential salt management strategies to offset the calculated long-term average salt loading to the Main Basin. The selected alternatives generally fall into three categories:

- Management of artificial recharge to take advantage of low TDS imported water when available;
- Pump and deliver more groundwater to customers so more salts are exported as wastewater; and
- Construct and operate groundwater demineralization facilities that remove salts from pumped groundwater and export them as waste by-products (concentrate/brine).

Factors used to track salt loading include data and information collected from the various monitoring programs (Section 3). The existing monitoring programs are sufficient for tracking salt loading from existing sources and for existing land use conditions. Future land use changes and any increased use of recycled water may require additional monitoring to track the resultant additional salt loading. The monitoring component of the SMP facilitates tracking any progress in salt removal.

In February 2009, the State Water Board adopted a Recycled Water Policy (State Water Board, Resolution No. 2009-0011) which requires that Salt Nutrient Management Plans (SNMPs) be completed for all groundwater basins in California by May 2014. While this requirement does not apply to a basin where a plan has already been approved by the Regional Water Board, Zone 7 plans to update the basin's Salt Management Plan (*Zone 7, 2004*) by the May 2014 deadline to conform to the State Water Board's new recycled water policy. The updated SNMP will evaluate the success of the demineralization plant on salt loading, fulfill nutrient and constituents-of-emerging-concern (CEC) requirements, evaluate salt loading impacts of increased recycled water use over the Main Basin, and assess the potential impacts of the water supply "portfolios" outlined in the Water Systems Evaluation (Zone 7, 2011c).

In addition, the original SMP planned for new monitoring wells along 14 basin boundary transects to evaluate subsurface inflow of salt into the Main Basin from the adjacent fringe basins. Many of the monitoring wells have now been installed, and their groundwater levels and quality have been monitored for several years. Staff will update the SMP's estimate of salt inflow from the fringe basins in the SNMP update, scheduled for completion in 2014.

5.2.3 Demineralization

In July 2007, Zone 7 started construction of the Mocho Groundwater Demineralization Plant (MGDP) to reduce salt build-up in the groundwater basin while improving delivered water quality to meet targets

established in Zone 7's Water Quality Policy. The facility went online in July 2009. It is a reverse osmosis (RO) membrane-based treatment system producing product water with extremely low TDS. The demineralized water is then blended with other groundwater (non-demineralized) or system water to achieve the desired overall delivered water TDS and hardness. The brine concentrate from the RO process is exported out of the watershed to San Francisco Bay through the regional wastewater export pipeline operated by LAVWMA. Based on Zone 7's projections, additional salt removal facilities may be required to keep pace with the additional salt loading projected for the basin as the overlying communities approach build-out.

Table: Salts Removed by Zone 7's Groundwater Demineralization Plant Operations (2011 Water Year)

Volume exported from Valley (AF)	Average TDS Concentration (mg/L)	Salt Mass Exported (Tons)	Tons Salt Removed per 1000 AF of Export
429	3,445	2,006	4,680

During the 2011 Water Year, 2,131 AF of groundwater from the Mocho Wellfield were routed through the demineralization plant's reverse osmosis (RO) membranes. As a result, 1,624 AF of very low-to-no-salt permeate was blended with system or other groundwater and fed into Zone 7's distribution system for delivery to Zone 7's customers. The RO process also generated approximately 429 AF of wastewater consisting of the water and the salts rejected by the membranes during the 2011 Water Year. This concentrate, or brine, contained about 2,006 tons of salt and was exported from the basin via the LAVWMA treated wastewater pipeline, which discharges to the San Francisco Bay. The discharge volumes and salt concentrations of the exported brine are monitored by DSRSD and reported to Zone 7 staff periodically throughout the year.

5.3 Groundwater Resource Protection Programs

5.3.1 Well Ordinance Program

The construction, repair, reconstruction, destruction or abandonment of wells within Zone 7 is currently regulated by Alameda County General Ordinance Code, Chapter 6.88. Zone 7 administers the associated well permit program within its service area including within the three incorporated cities: Dublin, Livermore, and Pleasanton. As a result, any planned new well construction, soil-boring construction, or well destruction must be permitted by Zone 7 before the work is started. Additionally, all unused or abandoned wells must be properly destroyed; or, if there are plans to use the well in the future, a signed statement of future intent must be filed at Zone 7. There is currently no fee for the Zone 7 permits.

A copy of the current Zone 7 drilling permit application is available for download from the Zone 7 web-site. Zone 7 must receive permits at least five days prior to beginning any drilling. Well construction and destruction permit requirements are determined on a case-by-case basis, but generally follow DWR's California Well Standards (Bulletins 74-81 and 74-90). This program allows Zone 7 to protect the groundwater basin from any negative impacts that would be threatened by poorly-constructed wells.

Zone 7 issued 140 drilling permits in the 2011 Calendar Year (130 in 2010). Zone 7 tracks the purpose of each project requiring a drilling permit. Following is the itemization of the types of permits issued:

- 51 for drilling associated with geotechnical investigations;
- 36 for drilling associated with contamination investigations, monitoring and clean-ups;
- 3 for general groundwater monitoring;
- 26 for the destruction of existing wells;
- 23 for new water supply wells; and
- 1 for cathodic protection wells.

In 2011, about 50% of the permitted well work was physically inspected by Zone 7 permit compliance staff.

Zone 7 is in the process of creating its own "Well Ordinance" to regulate the construction, repair, reconstruction, destruction or abandonment of wells within the Zone 7 service area. It is currently relying on the Alameda County General Ordinance Code that recently replaced the original County Ordinance (No. 73-68), that Zone 7 and the cities of Livermore, Pleasanton and Dublin adopted. However, the General Ordinance is silent about Zone 7's jurisdiction within the County and within these cities. Once completed, and reviewed by the affected public agencies, the new Zone 7 ordinance will be presented to the Zone 7 Board of Directors and to the local City councils along with requests for rescission of their previous adoptions of County Ordinance 73-68, and for the adoption of the new Zone 7 ordinance. These actions are anticipated to take place in 2012.

5.3.2 Septic Tank Management Program

Although Alameda County Environmental Health (ACEH) issues permits for the operation, installation, alteration, and repair of onsite wastewater treatment systems in Alameda County; Zone 7 requires special approval for any the following septic systems located within the Valley:

- Any new septic system constructed, partially or fully, for a commercial or industrial use;
- Any conversion of a residential septic system to a commercial or industrial use; or
- Any new residential septic system that discharges greater than one rural residential equivalence of wastewater (i.e., greater than an annual average of 320 gallons/day).

In 1982, the Zone 7 Board of Directors adopted the "Wastewater Management Plan for the Unsewered, Unincorporated Area of Alameda Creek Watershed Above Niles (WMP)" and its recommended policies (Resolution No. 1037). In addition, a separate policy was established in 1983 that prohibits the use of septic tanks for new developments zoned for commercial or industrial uses (Resolution No. 1165). This prohibition can be waived by the Zone 7 Board if, "it can be satisfactorily demonstrated to the Board that the wastewater loading will be no more than the loading from an equivalent rural residential unit (on a five-acre lot) and said septic tank(s) will be in compliance with all other conditions and provisions."

No new commercial septic tank applications were received by Zone 7 during 2011; however system expansion/modification plans were reviewed for three existing commercial uses in South Livermore: two winery systems and one for a pet kennel.

Staff approval was given to ACEH for the Livermore Ranch Kennel's expansion on the basis that the post-project wastewater loading would be less than the pre-project loading because of an addition of a pre-treatment system that reduces nitrogen in the effluent. Consideration was also given for the fact that the kennel had been operating since prior to the 1982 WMP.

Both winery applications were for existing wineries with current commercial use authorizations on file with Zone 7. One application was for Concannon Vineyards, and involved an expansion of their office and bottling facilities. The other was for Crooked Vine Winery (formerly Stony Ridge Winery), and involved the closing of their delicatessen and expansion of their office and special event facilities. At the end of the Water Year, staff was still waiting on updated information on the total wastewater loading at each of the two sites, including the applied wastewater from all existing uses. Staff will assess whether the post-project loading is greater than the loading previously approved by the Board, and take action accordingly during the next water year.

Staff also gave approval for two residential septic system applications in 2011; one was for a remodeled residence on a commercial site (Garre Winery), while the other was for a secondary residential unit on an existing South Livermore residential site. The new Garre Winery system was approved as being "grandfathered" due to the unit's pre-existence on the site. The other case was approved with the condition that effluent from both units had to be run through a nitrogen-reducing treatment system capable of removing at least 50% of the nitrogen content prior to its discharge onsite.

5.3.3 Toxic Site Surveillance Program

Zone 7 documents and tracks sites across the groundwater basin that pose a potential threat to drinking water. Information on these sites is gathered from state, county, and local agencies, as well as from Zone 7's well permitting program. Each site has been assigned a Zone 7 number, which corresponds to a file number containing reports or other information about the site. In addition, all sites are reviewed and given a priority designation (high, moderate, or low) based on criteria used by the RWQCB and ACEH that have been modified to meet Zone 7 standards. For example, a site is designated as high priority if contamination at the site is in groundwater at concentrations greater than the maximum contaminant level (MCL) and a water supply well is within 2,000 ft down-gradient of the site, or it is shown that drinking water or surface water will likely be impacted by the contamination at the site.

In general, the Toxic Site Surveillance Program has found two types of contamination threatening groundwater in the Livermore Valley Groundwater Basin:

- **Petroleum-based fuel products -** including total petroleum hydrocarbon as gasoline (TPHg), TPH as diesel (TPHd), benzene, toluene, ethylbenzene, xylene (collectively known as BTEX), and fuel oxygenates, such as methyl tertiary-butyl ether (MTBE) and tertiary-butyl alcohol (TBA). California has assigned clean-up standards (Title 22, California Code of Regulations) for the BTEX compounds and fuel oxygenates. However, a clean-up standard for total petroleum (TPHg or TPHd) has not officially been established.

- **Industrial chemical contaminants –** including the chlorinated solvents tetrachlorethylene (PCE), trichloroethylene (TCE), and their degradation by-products, such as vinyl chloride (VC) and dichloroethene (DCE). PCE is common in the dry cleaning business, and TCE is commonly used as a degreaser for electronics. Both PCE and TCE have an established maximum contaminant level (MCL, EPA National Primary Drinking Water Regulations) of 5 µg/L.

In 2011, Zone 7 tracked the progress of 70 active sites where groundwater contamination has been detected or contamination is threatening groundwater. Two contamination cases were closed during 2011, after they were determined to no longer pose a threat to drinking water. Maps have been generated that show the site locations, their priority, and their proximity to municipal supply wells for each main area of the groundwater basin: Livermore (Figure 5.3-1), Pleasanton (Figure 5.3-2), and Dublin (Figure 5.3-3).

As summarized in the latest program report (Zone 7, 2012), presented to the Zone 7 Board in April 2012, 16 of the sites are designated as high priority: ten in Livermore, five in Pleasanton, and one in Sunol. Although several sites in Dublin have elevated levels of MTBE (i.e., >10,000 parts per billion [ppb]) and one has elevated levels of TCE, none are classified as high priority because they are not near drinking water supply wells and are outside the Main Basin.

Twelve of the 16 high priority sites are fuel leak cases and the other four are the result of industrial solvent contamination. All of the twelve fuel leak cases are being overseen by ACEH. Seven cases have remediation underway, three fuel leak cases have completed a remediation workplan and the remaining two cases are working on completing site characterization. A domestic well in Sunol was impacted by one of these fuel leak sites and currently has a wellhead treatment system in operation.

Of the four high priority industrial solvent cases, two are being overseen by the RWQCB while the other two are not included in any of the Local Oversight Programs (LOP). Both of the RWQCB cases involve contamination from dry cleaner facilities; one in Pleasanton and one in Livermore. The Pleasanton site is now undergoing active remediation. The Livermore site has attempted remediation but with limited success; low-level PCE contamination has now reached two municipal supply wells located down-gradient of the Livermore dry cleaner site. The water purveyor is currently using granulated-activated carbon (GAC) filters to ensure against any customer health impacts. The lateral and vertical extent of contamination has been determined and an effective remedial action plan is being developed.

The other two industrial solvent cases which are of concern to Zone 7, but are not currently included in any of the LOP cases, also involve PCE contamination: one in Pleasanton and one in Livermore. The contamination in Pleasanton has impacted a public supply well, which has required the well owner to utilize GAC to remove the contamination prior to public consumption. Zone 7 is in the process of investigating a potential source for this site in order for the RWQCB to consider taking it on as a formal case in the RWQCB's oversight program. For the site in Livermore, a potential Responsible Party has been identified, but the extent of contamination has not been determined. Zone 7 is working with the RWQCB to expedite opening this site as a formal case in the RWQCB's oversight program and begin directing its further investigation.

5.4 Capital Projects

5.4.1 Chain of Lakes Recharge Projects

As mitigation for removal of aquifer material and interruption of groundwater movement resulting from the mining of aggregate resources between Livermore and Pleasanton, ten of the resulting quarry lakes, collectively called the Chain of Lakes (COL), will be deeded to the Zone 7 Water Agency for water resources management purposes (see Figure 5.4-1). Zone 7's planned uses for these lakes include water supply storage, capture and percolation of surface water, detention of flood waters, and enhancement of special-status species habitat. Full implementation of these uses is not expected before 2030 when the mining operations are projected to be complete. However, Zone 7 is working on several interim projects that are designed to convey, capture and recharge imported SWP water and mining discharge.

Near-term and long-term COL planning is provided for in Zone 7's current Capital Improvement Program (CIP) Ten-Year Water System Plan as a project in itself (i.e., Chain of Lakes Master Plan). The project concepts have been developed over time, and continuing to be refined; however, the main thrust to develop a detailed integrated use plan and the associated environmental impact analyses has been deferred until FY15-16 through FY17-18 due to CIP funding issues and priorities.

Recently, Zone 7 staff has begun collaborating with Vulcan Materials on a project to capture groundwater that they would normally discharge to the Arroyo Mocho, and be lost as "basin outflow". Vulcan produces varying quantities of groundwater, mostly from their quarry pit de-watering operations, and discharges a large portion of it into the Arroyo Mocho under the authority of an NPDES permit issued by the RWQCB. This project would extend their discharge line to one of the Zone 7-owned lakes, and then convey the water into Lake I where it will percolate through the sidewall and recharge the Amador Subbasin aquifers. It is estimated that this project will eliminate 1,500 to 4,000 AF of groundwater losses per year if constructed. The project's feasibility is still under consideration by staff; however, Zone 7 has assisted Vulcan with their Report of Discharge to the RWQCB for this project, and has completed CEQA in anticipation of the project moving forward.

Another near-term recharge enhancement project is the Arroyo Mocho Diversion, which is anticipated to be in service by 2014. This project will construct a fish-friendly stream diversion facility on the Arroyo Mocho that will divert imported SWP water released to the arroyo from the SBA into Lake H or Cope Lake and subsequently conveyed into Lake I to further enhance Zone 7's artificial aquifer recharge capacity. Hanson Aggregates (Hanson) is responsible for the design, permitting, and construction of the diversion facility per the existing agreement between Zone 7 and Hanson (formerly Kaiser Sand and Gravel), 1987, and the Livermore Amador Valley Quarry Reclamation Specific Plan, 1980. Zone 7 is assisting Hanson, as necessary.

5.4.2 Well Master Plan

Zone 7's 2003 Well Master Plan identified the need for seven to nine new municipal water supply wells over the next 30 years to maintain Zone 7's potable water reliability goal. The reliability goal was established in 2002 by Zone 7 Resolution 02-2382. It requires Zone 7 to maintain sufficient water

production capacity to meet 100% of its Municipal and Industrial (M&I) customers' projected future needs, even during worse-case drought conditions. As additional benefits, these wells will provide Zone 7 with a better ability to conjunctively manage its water resources, optimize groundwater production while maintaining groundwater levels above the historic lows basin-wide, meet peak-day demands, and remove dissolved salts from the groundwater basin.

The first two new wells (COL 1 and COL 2), including the associated pipelines, pump stations and treatment facility, have since been constructed in the Chain of Lakes Wellfield, and have been fully operational for two years. Their combined maximum production capacity is estimated at eight million gallons per day (MGD). The next new wells are planned for completion in 2018, and will likely also be constructed in the Chain-of-Lakes Wellfield.

Additionally, in 2011, staff assessed the probable production capacities for several potential new well sites in the southern Bernal Subbasin while working with the City of Pleasanton on a proposed right-of-way exchange. The research was done using information contained on old well logs and supported with capacity projections made from the few supply wells operating in this part of the basin. The study concluded that production capacities for municipal supply wells constructed in the southern Bernal Subbasin are expected to range from 2,000 gpm to 1,000 gpm in the areas north of Bernal Ave., and 1,000 gpm to < 500 gpm south of Bernal Ave. Accordingly, it is recommended that the feasibility of any new wellsite(s) south of the fairgrounds be verified through exploratory drilling and testing.

5.4.3 Demineralization Plant

In July 2007, Zone 7 started constructing the Mocho Groundwater Demineralization Facility to halt salt build-up in the groundwater basin and to improve delivered water quality. The facility was completed in December 2009 and has been in operation for more than one year, albeit not continuously operated at full capacity during that time. Nonetheless, it was directly responsible for removing 2,006 tons of salt from the groundwater basin during the 2011 Water Year (see Section 5.2.3 for a more detailed description of this project).

Tentatively, Zone 7 plans to construct a second groundwater demineralization plant in about 2030, and possibly a third after that, if necessary. One issue of concern that could impede progress of these plans is that in order to extract more groundwater from the basin, there would need to be a way to replenish the groundwater at about the same rate in order to keep the groundwater supply sustainable. Although there are plans to increase the artificial recharge capacity of Zone 7's system, the actual water supply for the program and the actual percolation rate (and rate of plugging) for Lake I have not been firmly established. Both of these unknowns should be resolved in the coming years, well in advance of the future demineralization facility plans. Zone 7 staff will work more on these issues during its Salt/Nutrient Management Plan update effort.

5.4.4 Monitoring Wells

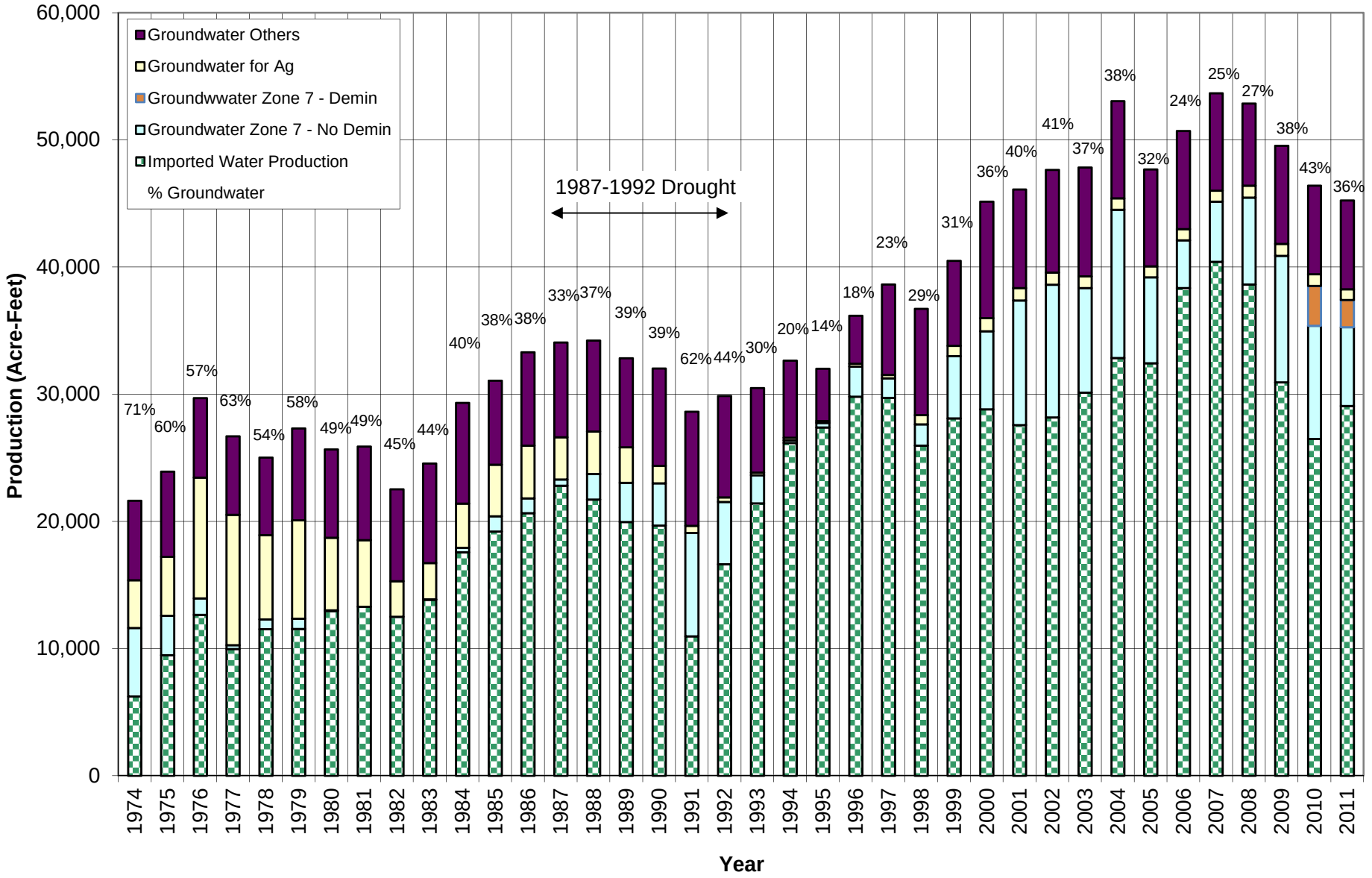
No new monitoring wells were installed during the 2011 Water Year. Three wells were identified for destruction. These wells are located in the Mocho Wellfield and are former supply and test wells that are no longer being used. In order to prevent the wells becoming vertical conduits for lower water quality to

move into the lower aquifers, these wells will be properly destroyed. The destruction design and specifications were completed in the 2011 Water Year and the destructions will be completed in the 2012 Water Year.

5.4.5 Other Projects

As reported in the 2010 Annual Groundwater Report, starting in the 2010 Water Year and continuing into the 2011 Water Year, Zone 7 performed a *Hydrostatic Investigation of the Aquifer Recharge Potential for Lakes C and D of the Chain of Lakes* (Zone 7, May 2011) in cooperation with the Department of Water Resources' Local Groundwater Assistance Program. The project investigated the potential connectivity between future Lakes C and D, of the future Chain-of-Lakes (Figure 5.4-1), and the productive aquifers in the West Amador Subbasin. The scope of work included drilling one exploratory borehole, performing borehole geophysical logging, and installing nested monitoring wells in the borehole (see Section 5.4.4). A pumping test was also performed to verify connectivity of hydrostratigraphic units. Zone 7 then evaluated the results to modify and extend Zone 7's network of cross sections south through the study area. The new nested wells have been incorporated into the Groundwater Monitoring Program (Section 3.2).

Figure 5.1-1
Valley Water Production from Imported Water and Groundwater Sources
1974 to 2011 Water Years



P:\WRE\GWMP\2011AnnRpt\Figures\Fig5.1-1-GWPercentages2011.XLS
5/28/2012

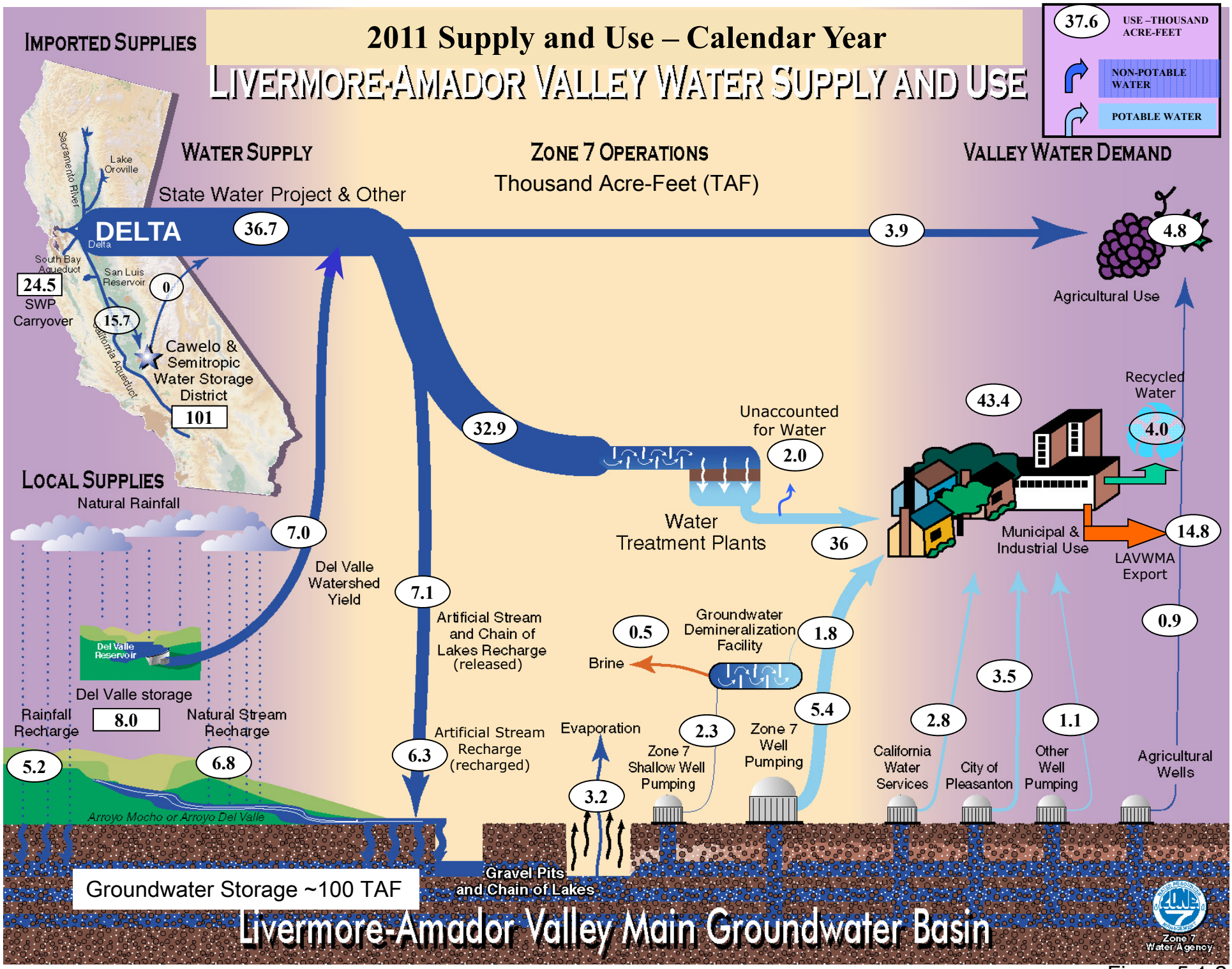
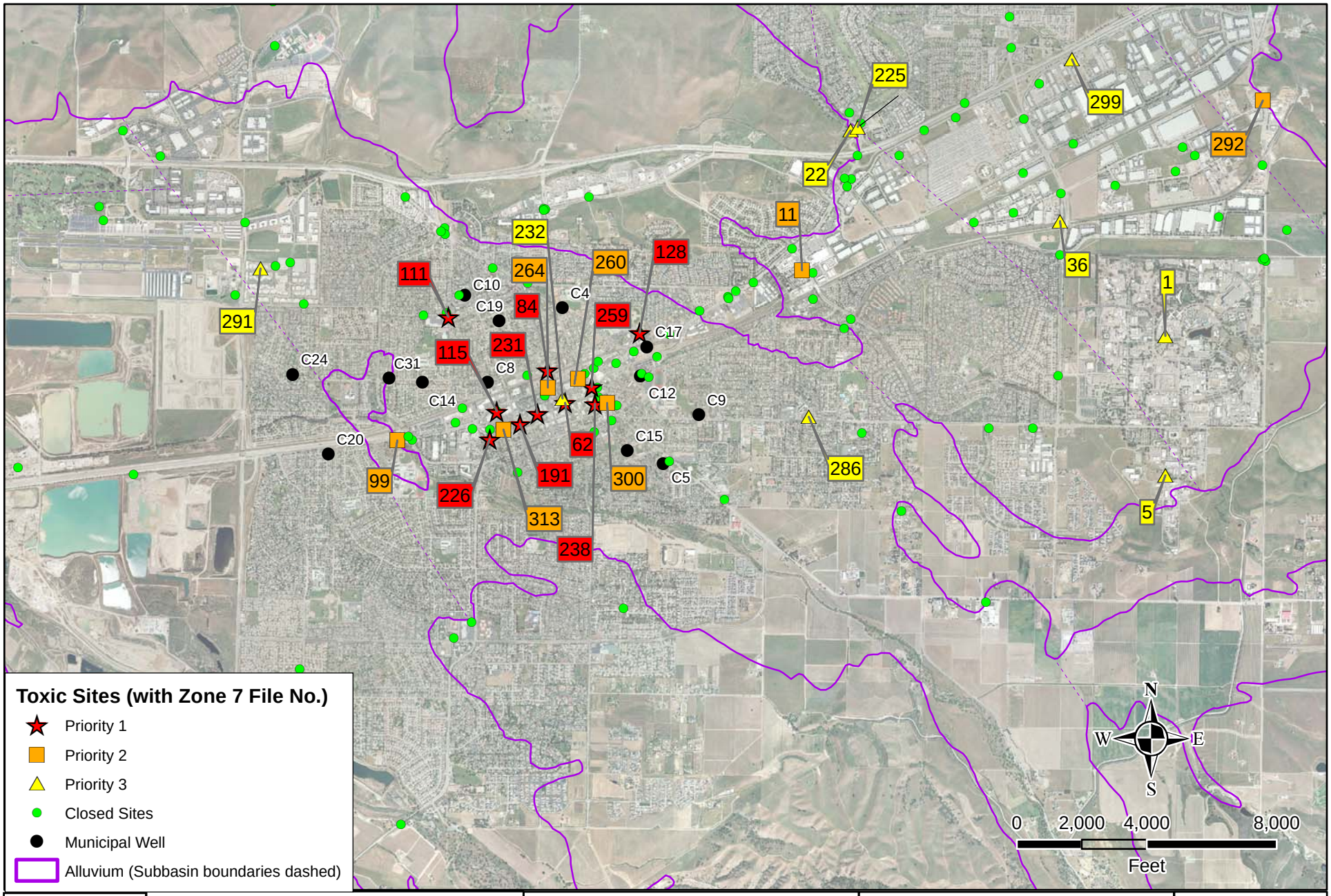
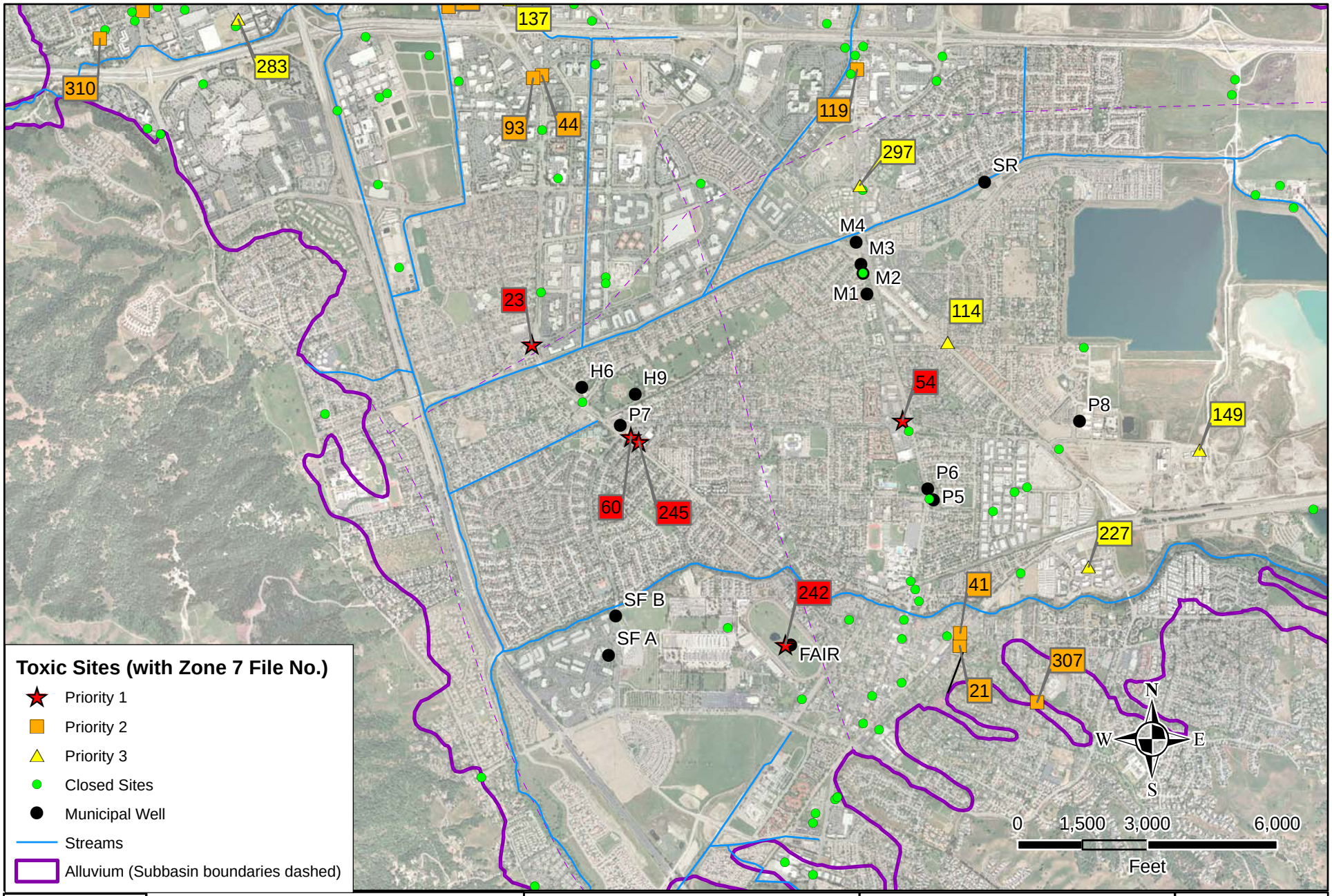

2011 Supply and Use – Calendar Year
LIVERMORE-AMADOR VALLEY WATER SUPPLY AND USE
37.6
USE –THOUSAND ACRE-FEET
NON-POTABLE WATER
POTABLE WATER
IMPORTED SUPPLIES
WATER SUPPLY
ZONE 7 OPERATIONS
Thousand Acre-Feet (TAF)
VALLEY WATER DEMAND
State Water Project & Other
Sacramento River
Lake Oroville
DELTA
Delta
36.7
3.9
4.8
Agricultural Use
South Bay Aqueduct
San Luis Reservoir
24.5
SWP Carryover
0
15.7
California Aqueduct
Cawelo & Semitropic Water Storage District
101
32.9
Unaccounted for Water
2.0
43.4
Recycled Water
4.0
LOCAL SUPPLIES
Natural Rainfall
7.0
Water Treatment Plants
36
Municipal & Industrial Use
14.8
LAVWMA Export
Del Valle Watershed Yield
7.1
Artificial Stream and Chain of Lakes Recharge (released)
0.5
Brine
Groundwater Demineralization Facility
1.8
0.9
Del Valle Reservoir
Del Valle storage
3.5
Rainfall Recharge
8.0
Natural Stream Recharge
5.4
2.8
1.1
Artificial Stream Recharge (recharged)
6.3
Evaporation
2.3
Zone 7 Shallow Well Pumping
Zone 7 Well Pumping
California Water Services
City of Pleasanton
Other Well Pumping
Agricultural Wells
5.2
6.8
Arroyo Mocho or Arroyo Del Valle
3.2
Gravel Pits and Chain of Lakes
Groundwater Storage ~100 TAF
Livermore-Amador Valley Main Groundwater Basin
Zone 7 Water Agency

Figure 5.1-2



ZONE 7 WATER AGENCY 100 North Canyons Parkway, Livermore, CA	DRAWN: CD/CW REVIEWED: MK File: E: \ Toxics\Toxics-Livermore.mxd	**Toxic Site Surveillance Livermore Area Sites**	Scale: 1" = 4000' Date: April 2012 Figure 5.3-1



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

DRAWN: CD/CW

REVIEWED: MK

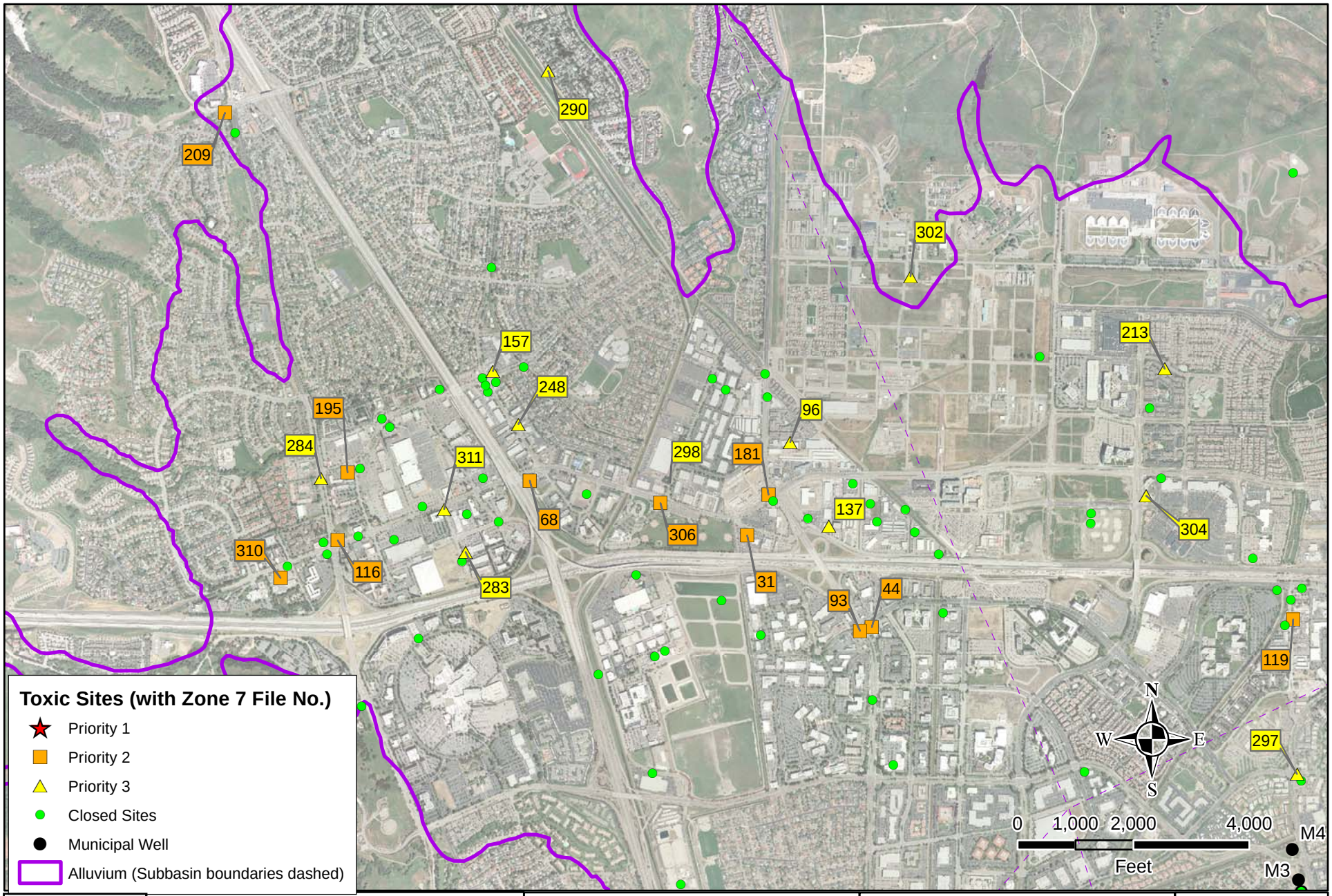
File: E: \ Toxics\Toxics - Pleasanton.mxd

Toxic Site Surveillance
Pleasanton Area Sites

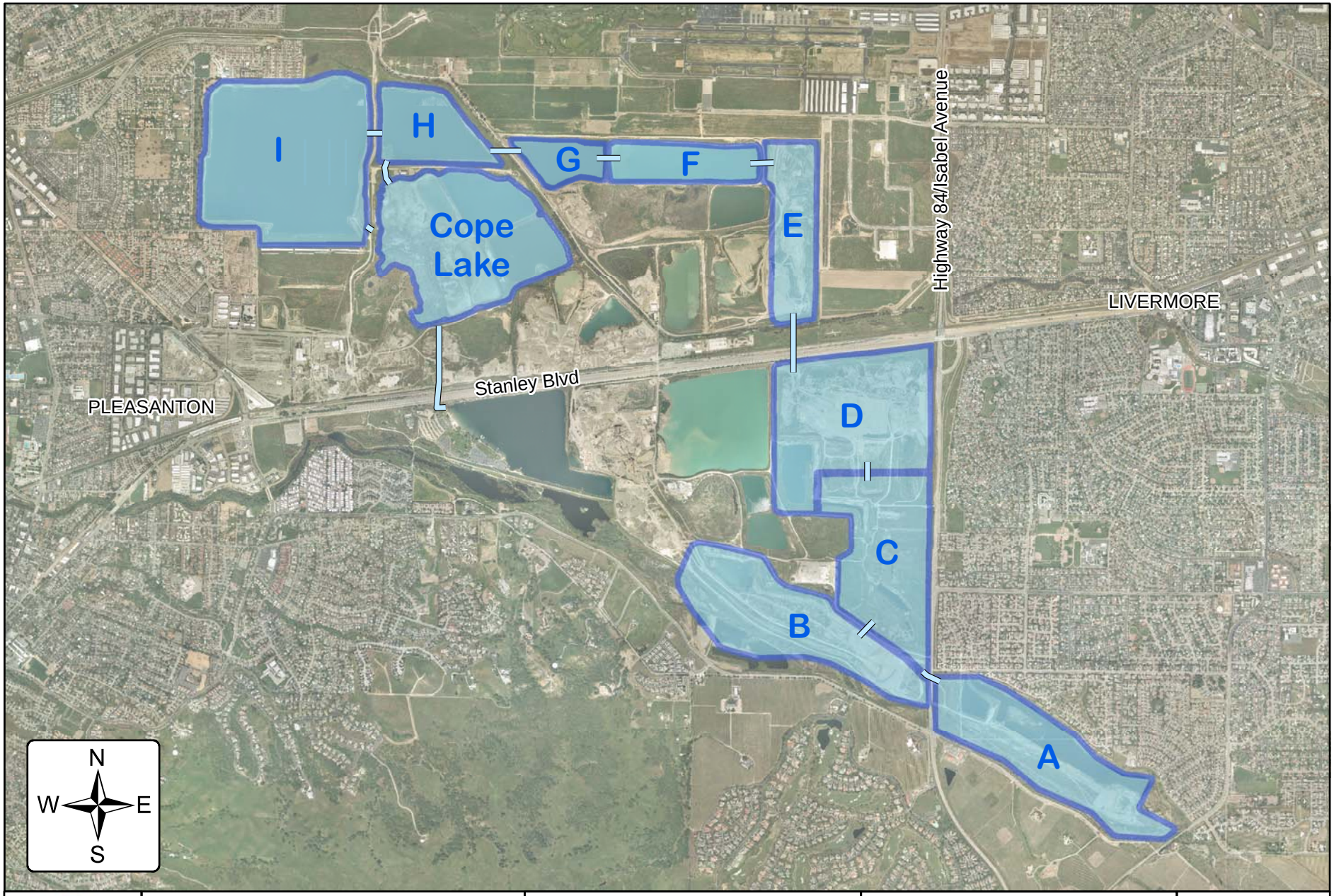
Scale: 1" = 3000'

Date: April 2012

Figure 5.3-2



ZONE 7 WATER AGENCY 100 North Canyons Parkway, Livermore, CA	DRAWN: CD/CW REVIEWED: MK File: E: \ Toxics\Toxics - Dublin.mxd	**Toxic Site Surveillance Dublin Area Sites (North of Main Basin)**	Scale: 1" = 2000' Date: April 2012 Figure 5.3-3



ZONE 7 WATER AGENCY 100 North Canyons Parkway, Livermore, CA	DRAWN: CW/TR REVIEWED: MK File: P:\WRE\GWMP\2011AnnRpt\Figures\Fig5.4-1-COL.mxd	**Location of Future Chain Of Lakes**	Scale: 1" = 3,000 ft Date:July 8, 2012 Figure 5.4-1