

14. Hydrology and Water Quality

This chapter describes the existing regulatory framework and environmental setting in Livermore related to hydrology and water quality. This chapter uses the term “Livermore” to cover the City of Livermore together with the immediately surrounding area within the Urban Growth Boundary (UGB) and Sphere of Influence (SOI). See the Introduction for more information on these boundaries.

14.1 REGULATORY FRAMEWORK

14.1.1 FEDERAL REGULATIONS

The following are federal regulations that pertain to hydrology and water quality within Livermore.

14.1.1.1 CLEAN WATER ACT

The United States Environmental Protection Agency (USEPA) is the lead federal agency responsible for water quality management. The Clean Water Act (CWA) (codified at 33 United States Code Sections 1251 to 1376) of 1972 is the primary federal law that governs and authorizes water quality control activities by the EPA, as well as the states. Various elements of the CWA, which address water quality, are discussed below.

Permits to dredge or fill waters of the United States are administered by the United States Army Corps of Engineers (USACE) under Section 404 of the CWA. “Waters of the United States” are defined as territorial seas and traditional navigable waters, perennial and intermittent tributaries to those waters, lakes and ponds and impoundments of jurisdictional waters, and wetlands adjacent to jurisdictional waters. The regulatory branch of the USACE is responsible for implementing and enforcing Section 404 of the CWA and issuing permits. Any activity that discharges fill material and/or requires excavation in waters of the United States must obtain a Section 404 permit. Before issuing the permit, the USACE requires that an analysis be conducted to demonstrate that a proposed project is the least environmentally damaging practicable alternative. Also, the USACE is required to comply with the National Environmental Policy Act before it may issue an individual Section 404 permit.

Under Section 401 of the CWA, every applicant for a Section 404 permit that may result in a discharge to a water body must first obtain State Water Quality Certification that the proposed activity will comply with State water quality standards. Certifications are issued in conjunction with USACE Section 404 permits for dredge and fill discharges. In addition, an application for Individual Water Quality Certification and/or Waste Discharge Requirements must be submitted for any activity that would result in the placement of dredged or fill material in waters of the State that are not jurisdictional to the USACE, such as isolated wetlands, to ensure that the proposed activity complies with State water quality standards. In California,

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the authority to either grant water quality certification or waive the requirement is delegated by the State Water Resources Control Board (SWRCB) to its nine Regional Water Quality Control Boards (RWQCB).

Under federal law, the USEPA has published water quality regulations under Volume 40 of the Code of Federal Regulations. Section 303 of the CWA requires states to adopt water quality standards for all surface waters of the United States. As defined by the CWA, water quality standards consist of two elements: (1) designated beneficial uses of the water body in question and (2) criteria that protect the designated uses. Section 304(a) requires the USEPA to publish advisory water quality criteria that accurately reflect the latest scientific knowledge on the kind and extent of all effects on health and welfare that may be expected from the presence of pollutants in water. Where multiple uses exist, water quality standards must protect the most sensitive use. In California, the USEPA has delegated authority to the SWRCB and its RWQCBs to identify beneficial uses and adopt applicable water quality objectives.

When water quality does not meet CWA standards and compromises designated beneficial uses of a receiving water body, Section 303(d) of the CWA requires that water body be identified and listed as “impaired”. Once a water body has been designated as impaired, a Total Maximum Daily Load (TMDL) must be developed for the impairing pollutant(s). A TMDL is an estimate of the total load of pollutants from point, nonpoint, and natural sources that a water body may receive without exceeding applicable water quality standards, with a factor of safety included. Once established, the TMDL allocates the loads among current and future pollutant sources to the water body.

14.1.1.2 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

The National Pollutant Discharge Elimination System (NPDES) permit program was established by the CWA to regulate municipal and industrial discharges to surface waters of the United States, including discharges from municipal separate storm sewer systems (MS4). Federal NPDES permit regulations have been established for broad categories of discharges, including point-source municipal waste discharges and nonpoint-source stormwater runoff. NPDES permits generally identify effluent and receiving water limits on allowable concentrations and/or mass emissions of pollutants in the discharge; prohibitions on discharges not specifically allowed under the permit; and provisions that describe required actions by the discharger, including industrial pretreatment, pollution prevention, self-monitoring, and other activities.

Under the NPDES Program, all facilities that discharge pollutants into waters of the United States are required to obtain a NPDES permit. Requirements for stormwater discharges are also regulated under this program. In California, the NPDES permit program is administered by the SWRCB through the nine RWQCBs. Livermore (lies within the jurisdiction of San Francisco Bay RWQCB (Region 2) and is subject to the waste discharge requirements for the Municipal Regional Permit (MRP; Order No. R2-2015-0049 and NPDES Permit No. CAS612008), with the last amendment, Order No. R2-2019-0004, taking effect on January 1, 2019.

Under Section C.3 of the NPDES Permit, the co-permittees use their planning authorities to include appropriate source control, site design, and stormwater treatment measures in new development and redevelopment projects to address both soluble and insoluble stormwater runoff pollutant discharges and prevent increases in runoff flows from new development and redevelopment projects. This goal is accomplished primarily through the implementation of low impact development techniques. In addition,

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projects that create and/or replace one acre or more of impervious surfaces and are located in a susceptible area must comply with the hydromodification requirements specified in the C.3.g provisions of the NPDES Permit. This requires that stormwater discharges shall not cause an increase in the erosion potential of the receiving stream as compared to pre-existing conditions. This typically requires Flow Duration Control (FDC) to ensure that post-project runoff does not exceed 10 percent of the pre-project flow rate for the 2-year up to the 10-year storm event. Livermore is within the hydromodification susceptibility zone.

14.1.1.3 FEDERAL EMERGENCY MANAGEMENT AGENCY

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP) to provide subsidized flood insurance to communities that comply with FEMA regulations limiting development in floodplains. FEMA also issues Flood Insurance Rate Maps (FIRMs) that identify which land areas are subject to flooding. These maps provide flood information and identify flood hazard zones in the community. The design standard for flood protection is established by FEMA. FEMA's minimum level of flood protection for new development is the 100-year flood event, also described as a flood that has a 1-in-100 chance of occurring in any given year.

As required by the FEMA regulations, all development constructed within the Special Flood Hazard Zone (as delineated on the FIRM) must be elevated so that the lowest floor is at or above the base flood elevation level. The term "development" is defined by FEMA as any human-made change to improved or unimproved real estate, including but not limited to buildings, other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, and storage of equipment or materials. Per these regulations, if development in these areas occurs, a hydrologic and hydraulic analysis must be performed prior to the start of development and must demonstrate that the development does not cause any rise in base flood elevation levels, because no rise is permitted within regulatory floodways. Upon completion of any development that changes existing Special Flood Hazard Area boundaries, the NFIP directs all participating communities to submit the appropriate hydrologic and hydraulic data to FEMA for a FIRM revision, as soon as practicable, but not later than six months after such data become available.

14.1.1.4 FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act provides the basic authority for the United States Fish and Wildlife Service (USFWS) to evaluate impacts to fish and wildlife from proposed water resource development projects. This act requires that all federal agencies consult with the USFWS, the National Marine Fisheries Service, and State wildlife agencies (i.e., the California Department of Fish and Wildlife [CDFW]) for activities that affect, control, or modify waters of any stream or bodies of water. Under this act, the USFWS has responsibility for reviewing and commenting on all water resources projects. For example, it would provide consultation to the USACE prior to issuance of a Section 404 permit.

If a project may result in the "incidental take" of a listed species, an incidental take permit is required. An incidental take permit allows a developer to proceed with an activity that is legal in all other respects but that results in the "incidental taking" of a listed species. A habitat conservation plan must also accompany an application for an incidental take permit. The purpose of a habitat conservation plan is to ensure that the effects of the permitted action on listed species are adequately minimized and mitigated.

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14.1.2 STATE REGULATIONS

The following are state regulations that relate to hydrology and water quality within Livermore.

14.1.2.1 PORTER-COLOGNE WATER QUALITY CONTROL ACT

The Porter-Cologne Water Quality Control Act (Water Code Sections 13000 et seq.) is the basic water quality control law for California. This act established the SWRCB and divided the state into nine regional basins, each under the jurisdiction of an RWQCB. The SWRCB is the primary State agency responsible for the protection of California's water quality and groundwater supplies. The RWQCBs carry out the regulation, protection, and administration of water quality in each region. Each regional board is required to adopt a water quality control plan or basin plan that recognizes and reflects the regional differences in existing water quality, the beneficial uses of the region's ground and surface water, and local water quality conditions and problems. As stated previously, Livermore is within the jurisdiction of the San Francisco Bay RWQCB (Region 2).

The Porter-Cologne Act also authorizes the SWRCB and RWQCBs to issue and enforce waste discharge requirements, NPDES permits, Section 401 water quality certifications, or other approvals. Other State agencies with jurisdiction over water quality regulation in California include the California Department of Health Services for drinking water regulations, the CDFW, and the Office of Environmental Health and Hazard Assessment.

14.1.2.2 SWRCB CONSTRUCTION GENERAL PERMIT

In California, the SWRCB has broad authority over water quality control issues for the State. The SWRCB is responsible for developing statewide water quality policy and exercises the powers delegated to the State by the federal government under the CWA.

Construction activities that disturb one or more acres of land that could impact hydrologic resources must comply with the requirements of the SWRCB Construction General Permit (CGP; 2009-0009-DWQ) as amended by 2010-0014-DWQ and 2012-0006-DWQ. Under the terms of the permit, applicants must file Permit Registration Documents (PRD) with the SWRCB prior to the start of construction. The PRDs include a Notice of Intent, risk assessment, site map, Stormwater Pollution Prevention Plan (SWPPP), annual fee, and a signed certification statement. The PRDs are submitted electronically to the SWRCB via the Stormwater Multiple Application and Report Tracking System (SMARTS) website. On May 28, 2021, the SWRCB issued a draft of the revised Statewide CGP which when approved would supersede Order 2009-0009-DWQ and its amendments.

Applicants must also demonstrate conformance with applicable best management practices (BMPs) and prepare a SWPPP containing a site map that shows the construction site perimeter, existing and proposed buildings, lots, roadways, stormwater collection and discharge points, general topography both before and after construction, and drainage patterns across the project site. The SWPPP must list BMPs that would be implemented to prevent soil erosion and discharge of other construction-related pollutants that could contaminate nearby water resources. Additionally, the SWPPP must contain a visual monitoring program,

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a chemical monitoring program for nonvisible pollutants if there is a failure of the BMPs, and a sediment-monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

14.1.2.3 SWRCB TRASH AMENDMENTS

On April 7, 2015, the SWRCB adopted an amendment to the Water Quality Control Plan for Ocean Waters of California to control trash and Part 1, Trash Provisions, of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California. They are collectively referred to as "the Trash Amendments". The Trash Amendments apply to all surface waters of California and include a land-use-based compliance approach to focus trash controls on areas with high trash-generation rates. Areas such as high density residential, industrial, commercial, mixed urban, and public transportation stations are considered priority land uses. There are two compliance tracks for Phase I and Phase II MS4 permittees:

- Track 1: Permittees must install, operate, and maintain a network of certified full capture systems in storm drains that capture runoff from priority land uses.
- Track 2: Permittees must implement a plan with a combination of full capture systems, multi-benefit projects, institutional controls, and/or other treatment methods that have the same effectiveness as Track 1 methods.

The Trash Amendments provide a framework for permittees to implement their provisions. Full compliance must occur within 10 years of the permit, and permittees must also meet interim milestones such as average load reductions of 10 percent per year.

14.1.2.4 SWRCB GENERAL INDUSTRIAL PERMIT

The Statewide General permit for Stormwater Discharges Associated with Industrial Activities, Order No. 2014-0057-DWQ and amended by 2015-0122-DWQ (2018) implements the federally required stormwater regulations in California for stormwater associated with industrial activities that discharge to waters of the United States. This regulation covers facilities that are required by federal regulations or by the RWQCBs to obtain an NPDES permit. Dischargers are required to eliminate non-stormwater discharges, develop SWPPPs that include BMPs, conduct monitoring of stormwater runoff, and submit all compliance documents via the SWRCB's SMARTS program.

14.1.2.5 CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

The CDFW protects streams, water bodies, and riparian corridors through the streambed alteration agreement process under Sections 1601 to 1606 of the California Fish and Game Code. The Fish and Game Code stipulates that it is "unlawful to substantially divert or obstruct the natural flow or substantially change the bed, channel or bank of any river, stream or lake" without notifying the CDFW, incorporating necessary mitigation, and obtaining a streambed alteration agreement. CDFW's jurisdiction extends to the top of banks and often includes the outer edge of riparian vegetation.

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14.1.2.6 WATER CONSERVATION IN LANDSCAPING ACT OF 2006

The Water Conservation in Landscaping Act includes the State of California’s Model Water Efficient Landscape Ordinance (MWELO), which requires cities and counties to adopt landscape water conservation ordinances. The MWELO was revised in July 2015 via Executive Order B-29-15 to address the ongoing drought and build resiliency for future droughts. State law requires all land use agencies, which includes cities and counties, to adopt a WELO that is at least as efficient as the MWELO prepared by the DWR. The 2015 revisions to the MWELO improve water conservation in the landscaping sector by promoting efficient landscapes in new developments and retrofitted landscapes. The revisions increase water efficiency by requiring more efficient irrigation systems, incentives for grey water usage, improvements in on-site stormwater capture, and limiting the portion of landscapes that can be covered in high-water-use plants and turf. New development projects that include landscape areas of 500 square feet or more are subject to the MWELO. This applies to residential, commercial, industrial, and institutional projects that require a permit, plan check, or design review. The previous landscape size threshold for new development projects ranged from 2,500 square feet to 5,000 square feet.¹ The size threshold for rehabilitated landscapes has not changed and remains at 2,500 square feet.

The City of Livermore has enacted these provisions as a “water efficient landscape ordinance”, as codified in the Livermore Municipal Code (LMC) Section 13.25, Water-Efficient Landscape.

14.1.3 REGIONAL REGULATIONS

The following are regional regulations that relate to hydrology and water quality within Livermore.

14.1.3.1 SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD

Livermore is within the jurisdiction of the San Francisco Bay RWQCB (Region 2). The San Francisco Bay RWQCB addresses regionwide water quality issues through the creation and triennial update of the *San Francisco Bay Basin Water Quality Control Plan* (Basin Plan). The Basin Plan was adopted in 1995 and most recently amended May 4, 2017. This Basin Plan designates beneficial uses of the State waters within Region 2, describes the water quality that must be maintained to support such uses, and provides programs, projects, and other actions necessary to achieve the standards established in the Basin Plan.² The San Francisco Bay RWQCB also administers the MRP for the municipalities within Alameda County, including the City of Livermore. Additional information regarding this permit is provided in the NPDES section above.

¹ California Department of Water Resources, 2015. Updated Model Water Efficient Landscape Ordinance, Guidance for California Local Agencies, <https://water.ca.gov/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/Model-Water-Efficient-Landscape-Ordinance>, accessed on September 10, 2021.

² San Francisco Bay RWQCB, 2017 *Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin*, https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/planningtmdls/basinplan/web/docs/BP_all_chapters.pdf, accessed on September 14, 2021.

HYDROLOGY AND WATER QUALITY**14.1.3.2 ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM**

The Alameda Countywide Clean Water Program (ACCWP) provides technical assistance to member agencies and the public to ensure compliance with the federal CWA and also coordinates its activities with other programs, such as wastewater treatment, hazardous waste disposal, and water recycling.³ The City of Livermore is a co-permittee under the ACCWP with 17 other cities and local agencies. As a part of the program, the City implements an inspection program requiring local businesses to implement BMPs to minimize stormwater pollution.⁴

The ACCWP monitors pollutants in surface waters (i.e., creeks, lakes, and San Francisco Bay) and implements an outreach and education program. The ACCWP C.3 Stormwater Technical Guidance Manual provides post-construction requirements and resources, including BMPs for stormwater pollution prevention, erosion control, low impact development (LID) treatment measures, and hydromodification requirements.⁵ Site design requirements are provided for small construction projects that create or replace at least 2,500 square feet but less than 10,000 square feet of impervious surface or individual single family home projects that create and/or replace 2,500 square feet or more of impervious area. Additional resources are provided at ACCWP's website, including post-construction stormwater requirements, sizing calculations for drainage management areas, and general water quality information.⁶

14.1.3.3 ZONE 7 WATER AGENCY

Zone 7 of the Alameda County Flood Control and Water Conservation District (Zone 7 Water Agency) provides regional flood protection for 427 square miles of eastern Alameda County, and currently owns and maintains approximately 37 miles of natural streams and flood control channels.⁷ Additionally, Zone 7 Water Agency is a wholesale water purveyor and is the designated groundwater sustainability agency for the Livermore-Amador Valley Groundwater Basin. Zone 7 Water Agency collaborates with the DWR in their role to provide State Water Project water supplies to the region and to manage Lake Del Valle for water storage, flood control, and recreational uses.

Zone 7 Water Agency maintains approximately one-third of the creeks in the Livermore-Amador Valley. This includes portions of the Arroyo Las Positas, relocated Arroyo Las Positas, Altamont Creek, a portion of Arroyo Mocho, Arroyo Seco, and Collier Canyon Creek.

³ Alameda County, 2021, About the Clean Water Program <https://www.cleanwaterprogram.org/about-us.html>, accessed on September 14, 2021.

⁴ City of Livermore, 2019. *Community Services and Infrastructure Report*.

⁵ Alameda County, 2021. C.3 Stormwater Technical Guidance, 3rd Revision, dated February 8, 2021. Accessed on September 17, 2021 at https://cleanwaterprogram.org/images/uploads/C.3_Technical_Guidance_Version_7.1_20210208.pdf.

⁶ Alameda Countywide Clean Water Program, 2017. Resources accessed on September 17, 2021 at <https://cleanwaterprogram.org/resources/resources.html>.

⁷ City of Livermore, 2019. *Community Services and Infrastructure Report*.

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14.1.3.4 2018 TRI-VALLEY LOCAL HAZARD MITIGATION PLAN

The Tri-Valley Local Hazard Mitigation Plan (LHMP) includes policies, programs, and projects to alleviate hazards and disasters within the cities of Dublin, Livermore, and Pleasanton (Tri-Valley region).⁸ As part of the LHMP, a hazard risk assessment was conducted for the three cities, including flooding and dam failure. Hazard mitigation principles, goals, and objectives were developed as well as a mitigation action plan designed to reduce or eliminate losses resulting from natural disasters.

14.1.4 LOCAL REGULATIONS

The following are local regulations that relate to hydrology and water quality within Livermore.

14.1.4.1 LIVERMORE 2003-2025 GENERAL PLAN

The City of Livermore 2003-2025 General Plan contains goals, objectives, policies, and actions addressing hydrology and water quality, as listed in Table 14-1.

TABLE 14-1 CITY OF LIVERMORE 2003-2025 GENERAL PLAN OBJECTIVES, POLICIES, AND ACTIONS PERTAINING TO STORMWATER

Goal PS-3	Protect lives and property from wildland fire hazard.
Objective LU-4.1.	Protect the Municipal Airport from encroachment by incompatible uses.
Policy LU-4.1-P1	Impacts to wetland and biological resources shall be calculated on a gross acreage basis and shall include areas of steep slopes, streets, floodways, and parks dedications that could result in losses of wildlife and plant habitat on a parcel.
Policy LU-4.1-P2	The City shall encourage the clustering of development in order to minimize its overall footprint in areas of ecological sensitivity, such as hillsides, alkali springs, creek corridors, and watersheds.
Objective LU-4.2	Ensure that new development complements its local context and minimizes impacts on the environment.
Policy LU-4.2-P1	New development shall be designed to respect and enhance Livermore's existing development and natural environment.
Policy LU-4.2-P2	The use of "green construction" and land development techniques shall be encouraged as a means to reduce the environmental impacts of construction activity.
Policy LU-4.2-P3	Encourage all additions and new development to follow green building practices for design, construction, and operation and to incorporate as many LEED prerequisites and credits as feasible.
Action LU-4.2-A1	Use the Housing Implementation Program (HIP), design review process, and specific plans to ensure that development meets community concerns for visual quality and environmental sensitivity.
Objective CC-1.1	Use open space to protect and enhance local community character and identity, to preserve rural characteristics, and to provide an edge to urban growth.
Policy CC-1.1-P11	The City shall preserve and enhance, or work with and support the efforts of other agencies, as appropriate (e.g., with joint grant applications, sharing of staff resources and legal services), to preserve and enhance the following natural amenities: (a) Ridgelines (b) Oak Woodlands and Grasslands (c) Grasslands (d) Riparian Woodland (e) Arroyos and Creeks (f) Knolls (g) Brushy Peak (h) Arroyo Mocho/Cedar Mountain (i) Corral Hollow (j) Sycamore Grove (k) Hilltops (NLUGBI) (l) Slopes (NLUGBI) (m) Viewscapes (NLUGBI) (n) Frick Lake (o) Springtown Alkali Sink

⁸ City of Livermore, Dublin and Pleasanton, 2018. *Tri-Valley Local Hazard Mitigation Plan*, prepared by Tetra Tech. Dated September 2018.

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TABLE 14-1 CITY OF LIVERMORE 2003-2025 GENERAL PLAN OBJECTIVES, POLICIES, AND ACTIONS PERTAINING TO STORMWATER

Objective CC-4.15	Control the alteration of streambeds and bodies of water in scenic routes.
Policy CC-4.15-P1	Alteration of streambeds or bodies of water and adjacent vegetation should be permitted only with approval of the local jurisdiction, as a means of preserving the natural scenic quality of stream courses, bodies of water, vegetation, and wildlife in the Valley.
Policy CC-4.15-P2	Development adjacent to streams, canals, reservoirs, and other bodies of water should be in a manner that will preserve the natural scenic qualities of the area, or when scenic qualities are minimal shall be designed and treated so as to result in naturalistic forms. Zone 7 has adopted Interim Design Standards and Practices for future improvements of channels. Any development with arroyos and creeks fall under these standards and are subject to Zone 7's review to ensure there are no impacts to Zone 7 facilities.
Objective INF-3.1	Plan, manage and develop the City's stormwater collection system in a logical, timely and appropriate manner.
Policy INF-3.1-P1	Design local storm drainage improvements to carry appropriate design-year flows resulting from build out of the General Plan.
Action INF-3.1-A1	Complete a new master plan for storm drainage facilities and update as needed, in order to accurately evaluate the storm drainage flows and determine appropriate facility improvements consistent with the General Plan.
Action INF-3.1-A2	Prioritize storm drainage improvements recommended in the storm drainage master plan and implement the projects through the City's Capital Improvement Program.
Objective INF-3.2	Encourage coordination between land use planning, site design and stormwater pollution control.
Policy INF-3.2-P1	All new development projects shall be responsible for constructing a stormwater collection system and contributing stormwater collection fees to construct additional necessary facilities. These fees include City storm drain fees as well as Zone 7 regional storm drainage fees.
Policy INF-3.2-P2	Criteria used to design the stormwater system shall be in the master plan prepared for storm drainage.
Policy INF-3.2-P3	The City shall take all necessary measures to regulate runoff from urban uses to protect the quality of surface and ground-waters and other resources from detrimental conditions.
Policy INF-3.2-P4	Installation of stormwater collection systems should occur concurrently with construction of new roadways to maximize efficiency.
Action INF-3.2-A1	Revise the Subdivision Ordinance and other Municipal Codes sections to reduce the creation of impermeable surfaces in new development. Examples of strategies to reach this goal might include: (a) Requiring the use of vegetative swales (biofilters). (b) Requiring detention/infiltration basins.
Action INF-3.2-A2	Existing property owners shall be encouraged, or required as appropriate, to reduce stormwater runoff by reducing impermeable surfaces.
Objective INF-3.3	Maintain creeks and arroyos in as natural a state as possible, while maintaining the health and safety of residents, providing flood control, preserving habitat and providing recreational use.
Policy INF-3.3-P1	Stream modifications should only be allowed for development in order to better contain flood flows, re-route stormwater to restore creek conveyance capacity and enhance groundwater recharge, stabilize creek beds and banks and control erosion, remove sediment and debris, provide public access for maintenance and emergency vehicles, provide for trails and recreational facilities, restore natural habitat and wetland areas and provide for water filtration.
Policy INF-3.3-P2	Any stream modifications and flood control structure improvements shall be done in accordance with appropriate engineering design, resource agency approvals, and current environmental restoration best management practices.
Policy INF-3.3-P3	Recreational opportunities adjacent to the arroyos and creeks shall be incorporated where possible. Primary bikeways to the arroyo and creek corridors as outlined in a master plan prepared for bikeways and trails.

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TABLE 14-1 CITY OF LIVERMORE 2003-2025 GENERAL PLAN OBJECTIVES, POLICIES, AND ACTIONS PERTAINING TO STORMWATER

Policy INF-3.3-P4	Arroyos shall not be channelized (i.e. converted to a trapezoidal form) or concrete lined. Modifications should only be allowed for public safety reasons. Flood control improvements such as capacity enhancement shall be done in accordance with appropriate engineering design and current environmental best practices.
Policy INF-3.3-P5	New Development shall be required to incorporate appropriate measures to minimize the impacts of stormwater runoff to local creeks and channels.
Action INF-3.3-A1	Educational opportunities regarding habitat and natural resources on local creeks and arroyos may be provided, as appropriate.
Action INF-3.3-A2	The City will work cooperatively with the parks districts, various County and private groups and organizations as appropriate to determine the site specific design criteria and conditions of acceptance as well as the long-term ownership and maintenance responsibilities. Expertise, long-term maintenance capability, acceptability of the improvements, type of facility, use, primary purpose of facility are among the factors that shall be used to evaluate agency, group or organization responsibility.
Action INF-3.3-A3	The City shall continue to cooperate with Zone 7 to improve and maintain the flood control system.
Action INF-3.3-A4	The City shall work with other agencies to determine the appropriate ownership and long-term maintenance responsibilities for each creek and arroyo property or easement.
Objective OSC-1.2	Minimize impacts to sensitive natural habitats including alkali sinks, riparian vegetation, wetlands and woodland forest.
Policy OSC-1.2-P2	Use and development of riparian areas should enhance the appearance of the creekside environment and protect and enhance native vegetation.
Policy OSC-1.2-P4	Riparian woodlands and freshwater marshes shall be preserved. Developers shall be required to mitigate possible adverse impacts upon these resource areas.
Policy OSC-1.2-P7	The City shall require project proponents to identify and map sensitive biological and wetland resources on each development parcel and identify the measures necessary to avoid and/or minimize impacts on sensitive biological and wetland resources prior to approving the development. Mitigation for impacts to sensitive biological and wetland resources shall replace the functions and values of the resources as well as gross acreage.
Policy OSC-1.2-P9	Development, conversion to cultivated agriculture, or keeping of animals is not permitted if the quantity or biological quality of wetlands would be reduced materially. "Wetlands" are areas permanently or periodically covered by water, where hydrophytic vegetation is present under normal circumstances, or that have soils primarily hydric in nature.
Policy OSC-1.2-P10	No building may be located in a riparian corridor. No development, conversion to cultivated agriculture, or keeping of animals may be permitted that materially reduces the quantity or quality of water in a corridor. Dams to store water for agriculture may be permitted, however, provided water is released in quantities and at times so as not to impair aquatic life or riparian vegetation. "Riparian corridors" are areas within 200 feet from the center of a permanent or intermittent stream
Objective OSC-1.4	Coordinate with other levels of government and interested agencies to preserve natural resources.
Policy OSC-1.4-P1	The City shall encourage the County of Alameda, East Bay Regional Park District, and the Livermore Area Recreation and Parks District to preserve and protect areas outside the Urban Growth Boundary.
Action OSC-1.4-A1	Work with local, regional, and State natural resource agencies and area non-profit organizations to develop programs to fund preservation of sensitive biological resources, including arroyos, wetlands, and grasslands.
Action OSC-1.4-A2	Work with other agencies such as Zone 7 and RWQCB to develop an intergovernmental program to reestablish the riparian community along major drainage ways in the Planning Area.

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TABLE 14-1 CITY OF LIVERMORE 2003-2025 GENERAL PLAN OBJECTIVES, POLICIES, AND ACTIONS PERTAINING TO STORMWATER

Objective OSC-2.1	Continue efforts to ensure that development does not harm the quality or quantity of Livermore's surface or ground water.
Policy OSC-2.1-P1	Require the implementation of Best Management Practices (BMPs) to minimize erosion, sedimentation, and water quality degradation resulting from the construction of new impervious surfaces.
Policy OSC-2.1-P2	The City shall take all necessary measures to regulate runoff from urban uses to protect the quality of surface and ground water.
Policy OSC-2.1-P3	The City shall work with Zone 7 to develop a recharge area map to guide future development. Developments proposed in areas identified as "valuable" to the recharge area shall mitigate adverse impacts to the greatest extent possible.
Policy OSC-2.1-P4	The City shall continue to work with Zone 7 to address on-going aquifer salt-loading in the basin.
Policy OSC-2.1-P5	The City shall contribute its fair share to the cost of implementing the plan developed by Zone 7 for salt management.
Action OSC-2.1-A1	Implement a program for integrated pest management (IPM) for City-managed landscaping areas that minimizes the use of pesticides and herbicides, and strives toward an organic pest-management approach. Provide incentives for the adoption of IPM practices on private land.
Objective PS-2.1	Minimize flood risks to development.
Policy PS-2.1-P1	Modification to the floodway will not be permitted in order to accommodate new adjacent development but will be permitted to restore creek capacity, stabilize creek banks, and restore habitat or water quality. However, modification of the land within the 100-year flood zone, but located outside of the floodway, will be permitted to protect the health and safety of existing development.
Policy PS-2.1-P2	When feasible, arroyos and creeks shall be preserved in their natural state, and shall not be channelized or otherwise altered. Floodways should remain undeveloped and be allowed to function as natural flood protection features where flood waters are temporarily stored and conveyed during intense storms.
Policy PS-2.1-P3	The City shall require new development and significant redevelopment projects to prepare drainage studies to assess storm runoff impacts on the local and regional storm drain and flood control system, and to develop recommended detention and drainage facilities to ensure that increased risks of flooding do not result from development. The drainage study shall include an analysis and recommended mitigations for projects that would increase peak runoff flows and increase runoff volume and for all projects where such increased flow and/or volume is likely to cause increased erosion of creek beds and banks, silt pollutant generation, or other impacts to beneficial uses.
Policy PS-2.1-P4	Only uses which have low flood damage potential and do not threaten other lands during times of flooding shall be permitted in the 100-year flood zone.
Policy PS-2.1-P5	Subject to the North Livermore Urban Growth Boundary Initiative (NLUGBI), the City shall permit development in a flood-prone area when it is demonstrated that such development will not (NLUGBI): (a) Interfere with the existing waterflow capacity of the floodway or substantially increase the erosion, siltation or chemical nutrients. (b) Contribute to the deterioration of any watercourse or the quality of water in any body of water. (c) Require storage of material, construction of any substantial grading or placement of fill.
Policy PS-2.1-P6	Development shall only be allowed on lands within the 100-year flood zone, if it will not: (a) Create danger to life and property due to increased flood heights or velocities caused by excavation, fill, roads and intended use. (b) Create difficult emergency vehicle access in times of flood. (c) Create a safety hazard due to the expected heights, velocity, duration, rate of rise and sediment transport of the flood waters expected at the site. (d) Create excessive costs in providing governmental services during and after flood conditions, including maintenance and repair of public utilities and facilities.
Policy PS-2.1-P7	Both public and private service facilities and utilities in existing 100-year flood zones shall be floodproofed to a point at or above the base flood elevation.

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TABLE 14-1 CITY OF LIVERMORE 2003-2025 GENERAL PLAN OBJECTIVES, POLICIES, AND ACTIONS PERTAINING TO STORMWATER

Policy PS-2.1-P8	The City shall prevent the construction of flood barriers within the 100-year flood zone which will divert flood water or increase flooding in other areas.
Policy PS-2.1-P9	Coordinate with Zone 7 and other appropriate agencies to construct creek improvements to protect public health and safety and to de-silt existing creeks while maintaining creeks in their natural state, whenever possible.
Objective PS-2.2	Minimize risks associated with potential failure of Del Valle and Patterson Dams.
Policy PS-2.2-P1	The City shall, in cooperation with the County of Alameda, prepare and maintain a disaster relief plan that addresses potential flood inundation in the areas below the Del Valle Reservoir and the Patterson Dam, as a result of dam failure.
Action PS-2.1-A1	Review the evacuation plan in the City's emergency management plan, as periodically amended, for the inundation areas regularly to ensure it is accurate and up-to-date.
Action PS-2.1-A2	Work with the California Department of Water Resources to ensure that adequate funding is being allocated for inspections of Del Valle and Patterson Dams, and that inspections and required maintenance are being carried out.

Source: The City of Livermore General Plan 2003-2025.

14.1.4.2 LIVERMORE MUNICIPAL CODE

In addition to the General Plan, the City of Livermore's Municipal Code provides a framework that shapes the development within the city. The Municipal Code includes sections regarding stormwater management and discharge control. See Table 14-2 for the related sections.

TABLE 14-2 CITY OF LIVERMORE MUNICIPAL CODE RELEVANT TO HYDROLOGY AND WATER QUALITY

Section	Title
13.25	Water Efficient Landscape - Enacted under the State Model Water Efficient Landscape Ordinance and is a "water efficient landscape ordinance" adopted to establish standards for designing, installing, and maintaining water efficient landscapes that avoid runoff and other water waste in landscape projects
13.26	Water Conservation - Establishes voluntary and mandatory water conservation measures, best management practices, and use penalties to encourage wise water use and to minimize the effect of shortages on the City's customers
13.44	Storm Drainage Facilities – Establishes stormwater drainage fees and credits and construction requirements for storm drainage facilities.
13.45	Stormwater Management and Control Program – The intent of this section is to protect and enhance the water quality of our watercourses, water bodies and wetlands in a manner pursuant to and consistent with the Federal Clean Water Act.
13.46	Stormwater System Enterprise Fund – Provides funding for stormwater management and discharge control program.
16.08	Watercourses – Prohibits obstructing watercourses or degrading water quality of water flowing through watercourses not within right-of-way under Zone 7 Water Agency and City of Livermore ownership.
16.12	Flood Control – Minimize public and private losses due to flood conditions in specific areas.

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14.1.4.3 LIVERMORE STORM DRAIN MASTER PLAN

In August 2021, the City received the Draft Storm Drain Master Plan (SDMP), which includes priority rankings for future improvement projects to be implemented through the current Capital Improvement Program (CIP).⁹ The Draft SDMP details how the prioritized CIP is established based on hydrologic and hydraulic modeling of the existing storm drainage system and provides estimates of the revenue stream needed to complete the CIP over 20 years. Example CIP projects include upsizing storm drains adjacent to numerous streets within the City Limits.

14.2 EXISTING CONDITIONS

14.2.1.1 CLIMATE AND TOPOGRAPHY

Livermore climate is characterized as Mediterranean, with mild to cool winters and hot, dry summers. However, it is close to being characterized as a semi-arid climate due to its relatively low annual precipitation of 15 inches per year.¹⁰ Most of the rainfall occurs between November and April. The average maximum temperature of 89 degrees Fahrenheit (F) occurs in August and the average minimum temperature of 36F occurs in January.

Livermore is located in Livermore Valley in eastern Alameda County, which is bordered to the north, south, and east by rolling hills. The central portion of Livermore, including the downtown area, is relatively flat with elevations ranging from 350 feet above mean sea level (msl) in the west to about 600 feet above msl in the east. The upland areas of Livermore consist of moderate to steeply sloping hills with elevations ranging from approximately 500 feet to more than 1,200 feet above msl.

14.2.1.2 REGIONAL HYDROLOGY

Approximately two-thirds of the East Bay is within the 660-square-mile Alameda Creek Watershed, which is further broken into sections and subwatersheds.¹¹ Livermore is located within four subwatersheds of the Upper Alameda Creek Watershed: Arroyo Mocho Subwatershed, Arroyo Las Positas Subwatershed, Arroyo Del Valle Subwatershed, and Chains of Lakes Subwatershed, as depicted on Figure 14-1. Overall, Livermore subwatersheds flow in a westerly direction to Arroyo de la Laguna, which drains to Alameda Creek near Sunol.

The four subwatersheds are described below:¹²

⁹ City of Livermore, 2021. *Draft Storm Drain Master Plan 2021*. Drafted Dated August 31, 2021.

¹⁰ US Climate Data, 2021. Climate of Livermore, California. Accessed on September 16, 2021, at <https://www.usclimatedata.com/climate/livermore/california/united-states/usca0618>.

¹¹ Alameda County Flood Control and Water Conservation District, 2021. Upper Alameda Creek Watershed – Northern Section. Access on September 17, 2021 at <https://acffloodcontrol.org/the-work-we-do/resources/upper-alameda-creek-watershed-north/>.

¹² Alameda County Flood Control and Water Conservation District, 2021. Upper Alameda Creek Watershed – Northern Section. Access on September 17, 2021 at <https://acffloodcontrol.org/the-work-we-do/resources/upper-alameda-creek-watershed-north/>.

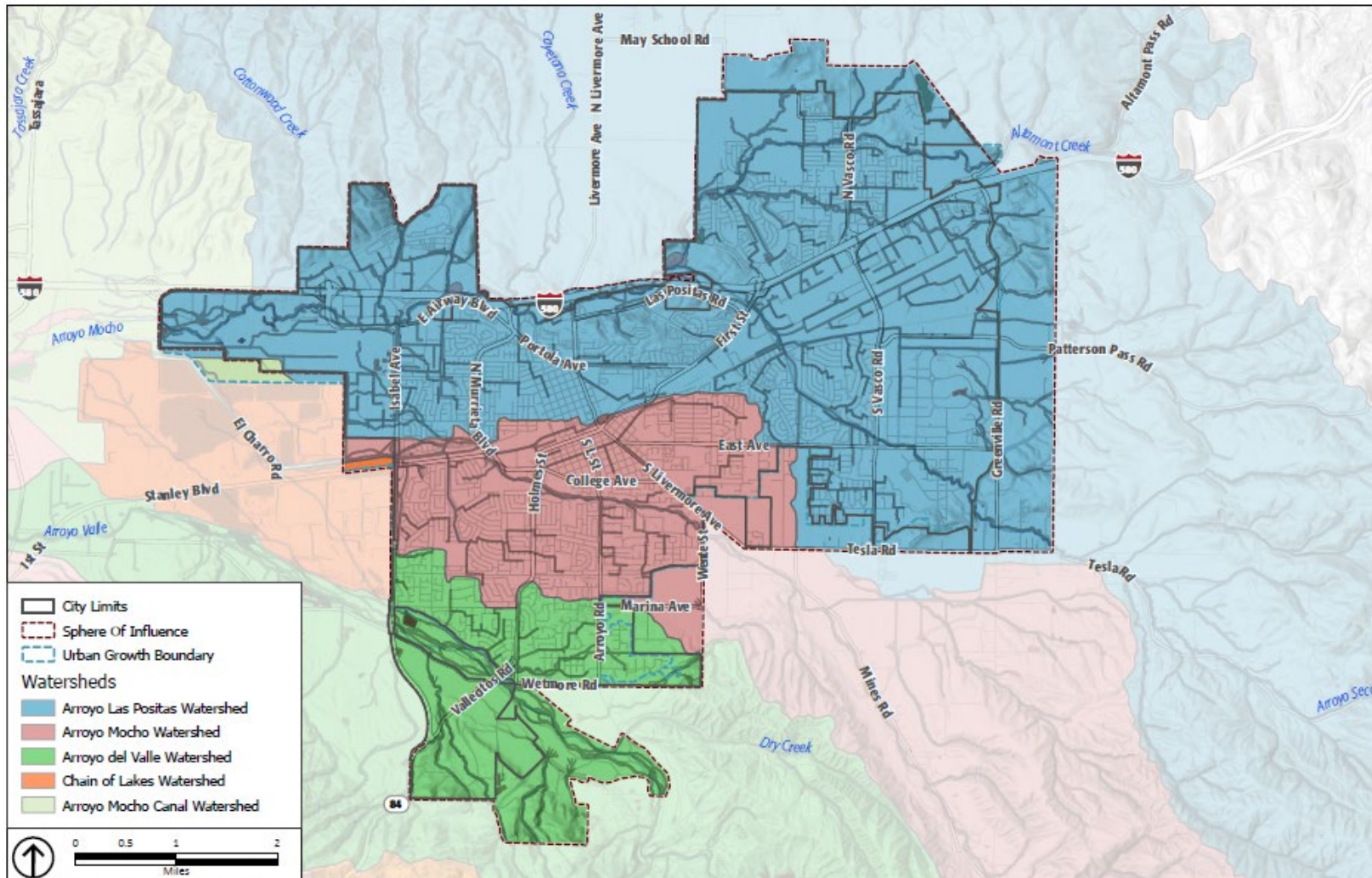
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- **Arroyo Mocho Subwatershed.** The Arroyo Mocho Subwatershed encompasses 54 square miles and drains a narrow-rugged canyon that extends approximately 20 miles southeast of Livermore, to its headwaters in northern Santa Clara County. The Arroyo Mocho flows northwest along Mines Road in Livermore, through Pleasanton, and eventually joins Alamo Canal to become Arroyo de la Laguna, which flows into Alameda Creek. Arroyo Mocho flows through the southern portion of Livermore and drains much of Livermore's Downtown area. The subwatershed includes Arroyo Mocho Creek, Tunnel Creek, and Mendenhall Springs.
- **Arroyo Las Positas Subwatershed.** Arroyo Las Positas encompasses 81 square miles and drains the Altamont pass and areas just north and east of Livermore. Arroyo Las Positas is a 7.4-mile-long westward-flowing watercourse that originates from the east of Livermore and empties into Arroyo Mocho in Livermore. It is mostly comprised of intermittent creeks, with some perennial water, and sparse riparian cover. The subwatershed includes Altamont Creek, Arroyo Seco, Cayetano Creek, Collier Canyon Creek, Cottonwood Creek, and Frick Lake.
- **Arroyo Del Valle Subwatershed.**¹³ Arroyo Del Valle Subwatershed encompasses 168 square miles and begins in the rugged mountains of the Diablo Range and flows northwest toward Livermore Valley. Before reaching the valley, it is impounded to create Lake Del Valle. Arroyo Del Valle flows through the southwestern portion of Livermore, with peak flows controlled by releases from Lake Del Valle. The subwatershed includes Arroyo Del Valle, Dry Creek, Shafer Creek, Trout Creek, Sycamore Creek, Colorado Creek, Arroyo Bayo, San Antonio Creek, Jumpoff Creek, Sulphur Springs Creek, Sweetwater Creek, Beauregard Creek, and Lake Del Valle.
- **Chain of Lakes Subwatershed.** Chain of Lakes is a 4.6-square-mile subwatershed that is a series of former quarry lakes, including Cope Lake and Shadow Cliffs Lake. The lakes were created by excavating sands and gravels that make up the groundwater aquifers. After mining is complete the former quarry pits fill with groundwater. Because they are connected to the groundwater aquifer, surface water added to the lakes drains into the ground, slowly filling the aquifers of the Livermore-Amador Valley groundwater basin.

¹³ Alameda County Flood Control and Water Conservation District, 2021. Upper Alameda Creek Watershed – Southern Section. Access on September 17, 2021 at <https://acffloodcontrol.org/the-work-we-do/resources/upper-alameda-creek-watershed-south/>.

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Figure 14-1 Regional Subwatersheds



Source: Alameda County Flood Control & Water Conservation District, 2021; City of Livermore, 2021; Esri, 2021.

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14.2.1.3 LOCAL HYDROLOGY

Zone 7 Water Agency owns and maintains approximately one-third of the creeks and channels in the Livermore-Amador Valley, including portions of Arroyo Las Positas, relocated Arroyo Las Positas, Altamont Creek, a portion of Arroyo Mocho, Arroyo Seco, and Collier Creek. The City of Livermore owns approximately seven miles of channels and creeks and maintains approximately 13 miles channels and creeks within the City Limits. Of the City-maintained creeks, approximately one third are improved concrete-lined or engineered earth channels with little or no vegetation. The remaining City-maintained creeks are natural arroyos with shallow banks and dense vegetation or are incised, sparsely vegetated with steep banks.

The City of Livermore's Public Works Department Water Resource Division (PWD) operates and maintains the storm drain system within the City Limits.¹⁴ The storm drain system covers an area of approximately 26 square miles and contains over 207 miles of pipe and three pump stations. The storm drain piping is generally concrete, with some corrugated metal pipes. The average age of the storm drain pipelines is around 40 years compared to an estimated service life of 100 years. There are several ditches or open channels within the existing developed areas, such as the Granada Channel, which flow to Arroyo Mocho. The City of Livermore also has an ongoing maintenance program for storm drainpipes and inlets, which includes catch basin cleaning, line repairs, and maintenance of the two pump-stations. Improvements to the storm drain system listed in the SDMP are implemented through the City's CIP, and include projects designed to upsize storm drains adjacent to streets within the City Limits and the installation of new pump stations to mitigate flooding at street intersections.¹⁵

14.2.1.4 GROUNDWATER

The Livermore Valley Groundwater Basin (or Basin) is an important water supply source for Zone 7 Water Agency. The Basin is shown on Figure 14-2 and is replenished by natural and artificial recharge. Zone 7 Water Agency, the City of Pleasanton, and the California Water Service Company (Cal Water) own wells that extract groundwater to supplement their surface water supplies.¹⁶ Zone 7 Water Agency currently has seven production wells in Pleasanton and three wells near the Chain of Lakes. The peak total capacity of these production wells is approximately 42 million gallons per day (MGD) and the normal operating capacity of these wells is approximately 32 MGD. Although the Main Basin groundwater meets the state water quality standards, Zone 7 Water Agency operates the Mocho Groundwater Demineralization Plant to remove salts from the groundwater basin and improve delivered water quality.

Shallow groundwater is present beneath Livermore, ranging in depths from 4 feet to 60 feet below ground surface.¹⁷ Shallow groundwater depths vary with large rainfall events and periods of drought and are at the highest levels (i.e., closest to the ground surface) during the rainy season and decreasing during the

¹⁴ City of Livermore, 2019. *Community Services and Infrastructure Report*.

¹⁵ City of Livermore, 2021. *Draft Storm Drain Master Plan 2021*. Drafted Dated August 31, 2021.

¹⁶ City of Livermore, 2019. *Community Services and Infrastructure Report*.

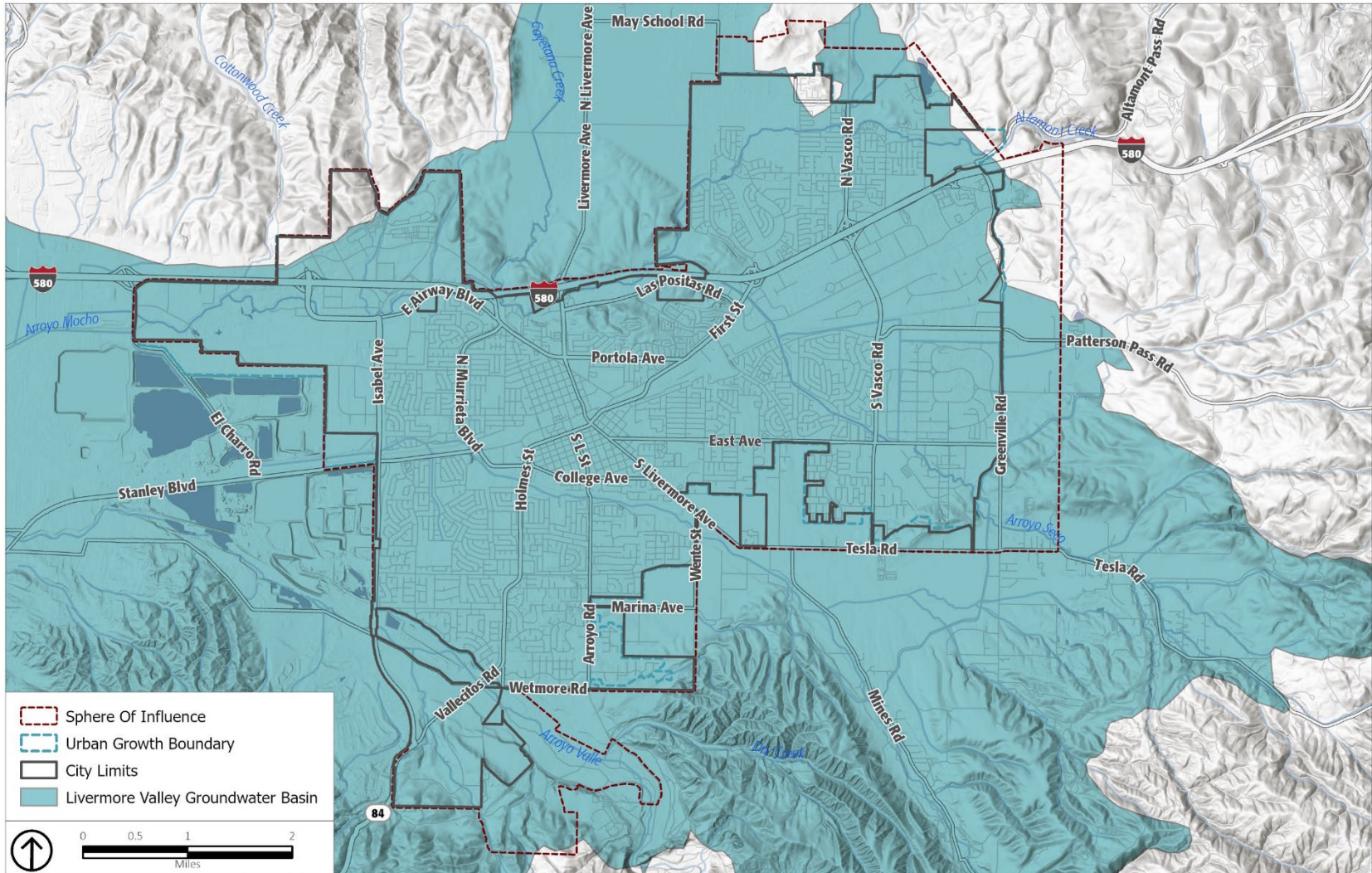
¹⁷ Gregg Drilling, 2017. Northern California Groundwater Depth Chart. Accessed at <http://www.greggdrilling.com/resources/> on September 17, 2021.

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drier months. Should construction dewatering be required during the excavation or grading phases of future projects, the extracted groundwater can be reused on-site for dust control, soil compaction, or irrigation, or it can be retained on-site in a temporary sediment pond for infiltration and evaporation. If dewatering wells are required, a permit must be obtained from the Zone 7 Water Agency. Discharge of extracted groundwater to the sanitary sewer would require a permit from the City's Water Resources Division (Sewer Section) and may require sampling and monitoring. Discharge of the extracted groundwater to the storm drain may require a site-specific NPDES Permit from the San Francisco RWQCB or it may be covered under the general NPDES permit. However, both the discharged groundwater and receiving water body would require sampling and monitoring with the results routinely reported to the RWQCB.

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Figure 14-2 Groundwater Basin



Source: California Department of Water Resources, 2016; City of Livermore, 2021; Esri, 2021; PlaceWorks, 2021

HYDROLOGY AND WATER QUALITY**14.2.1.5 WATER QUALITY**

Surface water quality is affected by point-source and nonpoint-source pollutants. Point source pollutants are emitted at a specific point, such as a pipe, and nonpoint-source pollutants are typically generated by surface runoff from diffuse sources, such as streets, paved areas, and landscaped areas. Point-source pollutants are controlled with pollutant discharge regulations or water discharge requirements. Nonpoint-source pollutants are more difficult to monitor and control, although they are important contributors to surface water quality in urban areas.

Stormwater runoff pollutants vary based on land use, topography, the amount of impervious surface, the amount and frequency of rainfall, and irrigation practices. Runoff in developed areas typically contains oil, grease, and metals accumulated in streets, driveways, parking lots, and rooftops, as well as pesticides, herbicides, particulate matter, nutrients, animal waste, and other oxygen-demanding substances from landscaped areas. The highest pollutant concentrations usually occur at the beginning of the wet season during the “first flush,” when early rainfall flushes out pollutants that have accumulated on hardscape surfaces during the preceding dry months.

The San Francisco Bay RWQCB monitors surface water quality through implementation of the Basin Plan and designates beneficial uses for surface water bodies and groundwater within Alameda County and Livermore. The beneficial uses for surface water bodies and groundwater within Livermore are listed in Table 14-3.

TABLE 14-3 DESIGNATED BENEFICIAL USES OF WATER BODIES IN LIVERMORE

Water Body	Designated Beneficial Use
Surface Water	
Arroyo Del Valle	MUN, GWR, COLD, MIGR, RARE, SPWN, WARM, WILD, REC-1, REC-2
Shadow Cliffs Reservoir	GWR, COMM, COLD, SPWN, WARM, WILD, REC-1, REC-2
Del Valle Reservoir	MUN, COMM, COLD, SPWN, WARM, WILD, REC-1, REC-2
Arroyo Mocho	GWR, COLD, MIGR, SPWN, WARM, WILD, REC-1, REC-2
Tassajara Creek	GWR, COLD, MIGR, RARE, SPWN, WARM, WILD, REC-1, REC-2
Arroyo Las Positas	GWR, COLD, MIGR, RARE, SPWN, WARM, WILD, REC-1, REC-2
Cottonwood Creek	RARE, WARM, WILD, REC-1, REC-2
Collier Canyon Creek	RARE, WARM, WILD, REC-1, REC-2
Cayetano Creek	RARE, WARM, WILD, REC-1, REC-2
Arroyo Seco	GWR, COLD, MIGR, RARE, SPWN, WARM, WILD, REC-1, REC-2
Altamont Creek	GWR, COLD, RARE, WARM, WILD, REC-1, REC-2
Groundwater	
Livermore Valley	MUN, PRO, IND, AGR

Notes: Municipal and Domestic Water Supply (MUN), Industrial Process Water Supply (PRO), Industrial Service Water Supply (IND), Agricultural Supply (AGR), Freshwater Replenishment (FRSH), Groundwater Recharge (GWR), Cold Freshwater Habitat (COLD), Fish Migration (MIGR), Preservation of Rare and Endangered Species (RARE), Fish Spawning (SPWN), Warm Freshwater Habitat (WARM), Wildlife Habitat (WILD), Water Contact Recreation (REC-1), Noncontact Water Recreation (REC-2).

Source: San Francisco Bay RWQCB, 2017. *Water Quality Control Plan (Basin Plan)*.

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In addition to the establishment of beneficial uses and water quality objectives, another approach to improve water quality is a watershed-based methodology that focuses on all potential pollution sources and not just those associated with point sources. If a body of water does not meet established water quality standards under traditional point source controls, it is listed as an impaired water body under Section 303(d) of the Clean Water Act. For Section 303(d) listed water bodies, a limit is established that defines the maximum amount of pollutants that can be received by that water body.

Listed impaired water bodies in Livermore and their associated pollutants of concern are presented below:¹⁸

- Arroyo Del Valle: diazinon (pesticide)
- Arroyo Mocho: diazinon
- Arroyo Las Positas: diazinon

Once a water body has been placed on the Section 303(d) list of impaired waters, the State is required to develop a TMDL threshold to address each pollutant causing impairment. A TMDL defines how much of a pollutant a water body can tolerate and still meet water quality standards. A TMDL has been approved by the EPA for diazinon in Arroyo Del Valle, Arroyo Mocho, and Arroyo Las Positas.

14.2.1.6 FLOOD ZONES

FEMA determines floodplain zones to assist cities in mitigating flooding hazards through land use planning. FEMA also outlines specific regulations for any construction within a 100-year floodplain. The 100-year floodplain is defined as an area that has a 1 percent chance of being inundated during a 12-month period. FEMA also prepares maps for 500-year floods, which mean that in any given year, the risk of flooding in the designated area is 0.2 percent. The portions of Livermore that are within the 100-year floodplain are shown on Figure 14-3.

In some locations, FEMA also provides measurements of base flood elevations for the 100-year flood, which is the minimum height of the flood waters during a 100-year event. Base flood elevation (BFE) is reported in feet above sea level. Depth of flooding is determined by subtracting the land's height above sea level from the base flood elevation. Areas within the 100-year flood hazard area that are financed by federally backed mortgages are subject to mandatory federal insurance requirements and building standards to reduce flood damage.

On the current digital FIRM for Livermore, large portions of Livermore are labeled Zone X (unshaded) – outside the 500-year floodplain and only small portions are within the 100-year floodplain (see Figure 14-3).¹⁹ According to the effective 2009 FEMA Flood Insurance Study for Alameda County, the principal flooding problems in the City of Livermore occur during the winter. Storm runoff is concentrated rapidly

¹⁸ State Water Resources Control Board, 2018 Integrated Report Map
https://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/2018_integrated_report/2018IR_map.html
, accessed on September 15, 2021.

¹⁹ *Tri-Valley Local Hazard Mitigation Plan*, adopted in September 2018.

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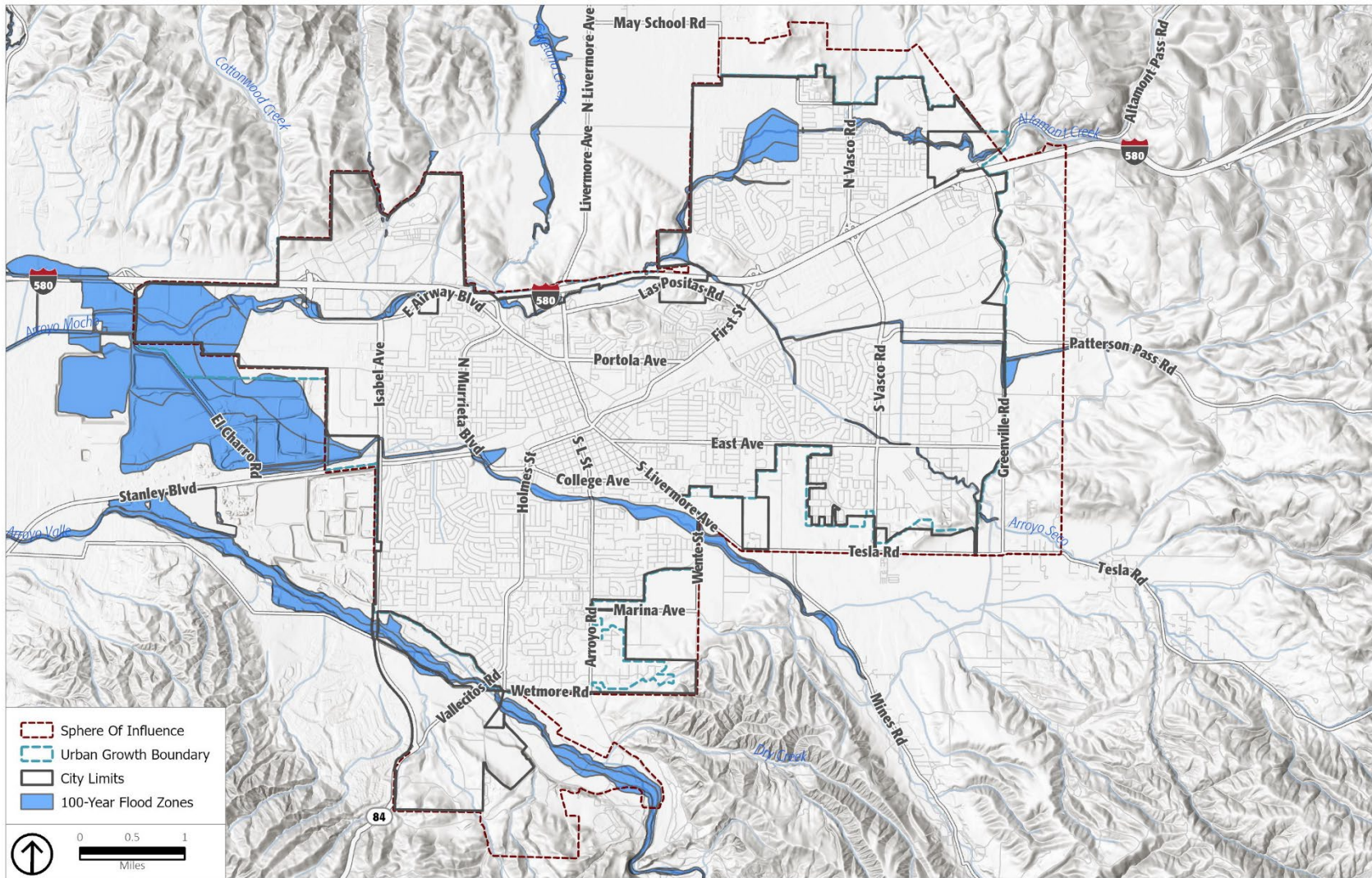
by the network of tributaries that discharge through the hills into the major streams. The tributaries have carved well-defined courses through the hills, but upon reaching the flat Livermore Valley, the channels become shallow and inadequate at various stream reaches for containing the flow from infrequent but high-volume storms. Constriction of Arroyo Seco flows at the Western Pacific and Southern Pacific Railroad crossing of the creek forces lower-frequency flood flows to spread out from these points.²⁰ Another constricting hydraulic factor is a length of the channel along Arroyo Las Positas downstream from Airway Boulevard. Rapid runoff rates, inadequate channels, and constricting structures combined with the development in some floodplain areas, make Livermore susceptible to damage when large rainstorms occur.²¹

²⁰ *Tri-Valley Local Hazard Mitigation Plan*, adopted in September 2018.

²¹ *Tri-Valley Local Hazard Mitigation Plan*, adopted in September 2018.

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Figure 14-3 100-Year Floodplain



Source: Federal Emergency Management Agency, 2020; City of Livermore, 2021; Esri, 2021.

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Some areas of Livermore are located within the dam inundation zones for Del Valle Dam and Patterson Dam. The dam inundation zones are shown on Figure 4-4. Patterson Dam is located east of Greenville Road and north of Patterson Pass Road. The Del Valle Dam is located approximately 2.5 miles south of Livermore. Both dams are owned and operated by DWR and used for water storage. The dams are regulated by DWR's Division of Safety of Dams (DSOD). Del Valle Dam is classified as an extremely high hazard dam due to the DSOD Downstream Hazard Classification guidelines.²² Patterson Dam is classified as a high hazard dam.^{23, 24}

There are no State or local restrictions for development within dam inundation zones. However, each dam owner is required to prepare an Emergency Action Plan (EAP) and coordinate its response to a dam break with local authorities. The EAP is required to include warning and notification procedures that typically involve the Standard Emergency Management System (SEMS), the Alameda County Sheriff's Office, county, and Livermore's Emergency Operations Center (EOC).

14.2.1.8 TSUNAMI AND SEICHES

A tsunami is a series of traveling ocean waves generated by a rare, catastrophic event, including earthquakes, submarine landslides, and submarine or shoreline volcanic eruptions. Tsunamis can travel over the ocean surface at speeds of 400 to 500 miles per hour or more, and wave heights at the shore can range from inches to 50 feet. Factors influencing the size and speed of a tsunami include the source and magnitude of the triggering event, as well as off-shore and on-shore topography.

Livermore is approximately 18 miles from San Francisco Bay and is not susceptible to inundation by tsunamis or other coastal hazards such as sea level rise.

A seiche is an oscillation wave generated in a closed or partially closed body of water, which can be compared to the back-and-forth sloshing in a bathtub. Seiches can be caused by winds, changes in atmospheric pressure, underwater earthquakes, tsunamis, or landslides into the water body. Bodies of water such as bays, harbors, reservoirs, ponds, and swimming pools can experience seiche waves up to several feet in height during a strong earthquake. There are no large bodies of water within Livermore that could trigger a seiche. Seismic activity at either Patterson Reservoir or Del Valle Reservoir could result in a wave that overtops the dams without causing dam failure. However, it is unlikely that flooding resulting from a seiche at either dam would reach Livermore.

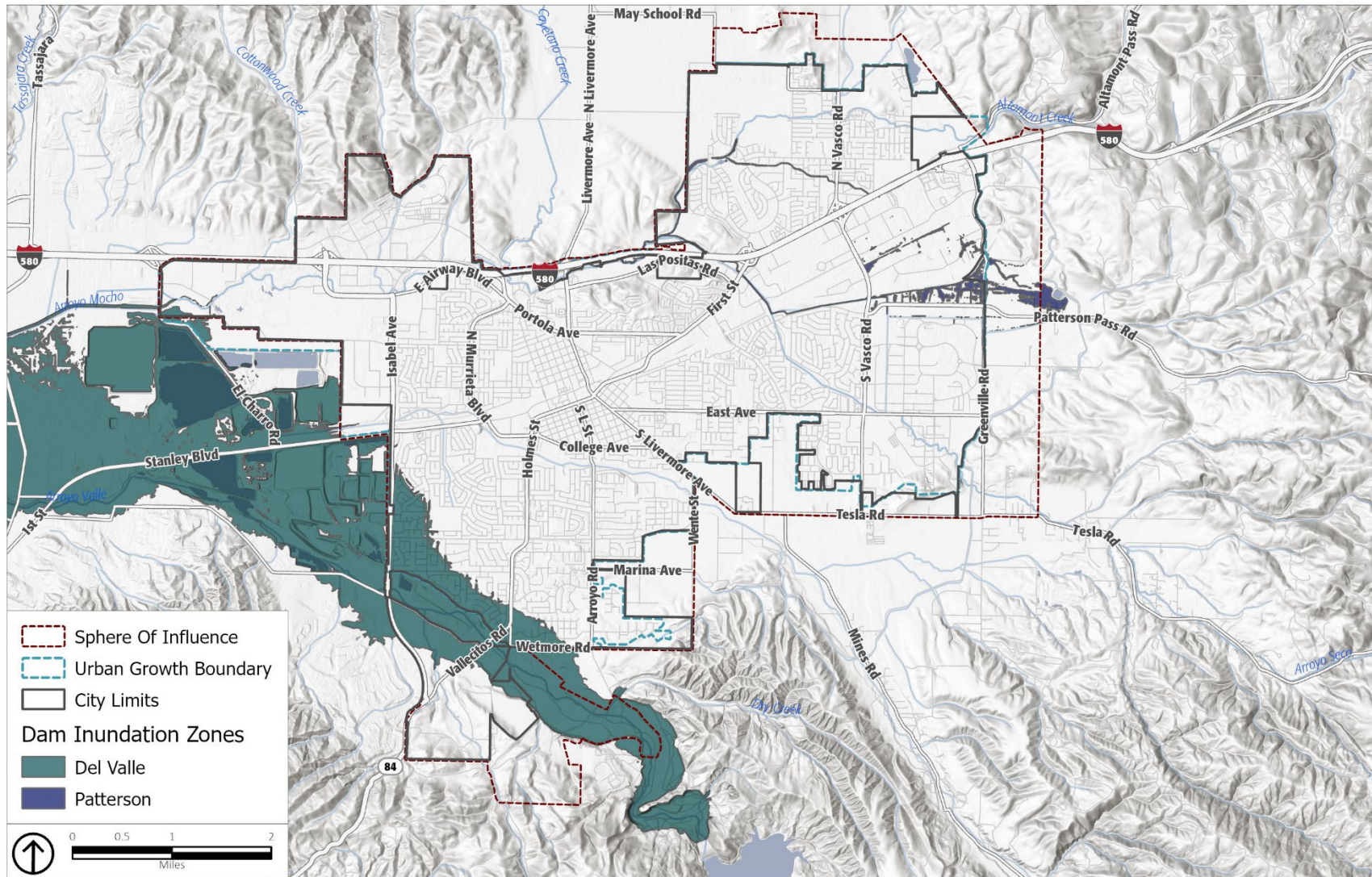
²² Extremely High Hazard Definition: Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more, Department of Water Resources, 2020.

²³ High Hazard Definition: Expected to cause loss of at least one human life, Department of Water Resources, 2020.

²⁴ *Tri-Valley Local Hazard Mitigation Plan*, adopted in September 2018.

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Figure 14-4 Dam Inundation Zones



Source: California Governor's Office of Emergency Services, 2017; City of Livermore, 2021; Esri, 2021.

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14.3 IMPLICATIONS FOR THE GENERAL PLAN UPDATE

Based on information contained in this chapter, the General Plan Update should consider the following:^{25,26}

- Ongoing implementation of BMPs for stormwater retention, detention, and infiltration to reduce impacts to existing stormwater infrastructure.
- Minimizing hardscape and promoting natural landscaping to reduce water quality impacts and improve stormwater flow.
- Implementing storm drain improvements through the Capital Improvement Program (CIP) and Storm Drain Master Plan prevent flooding.
- Coordinating with the Department of Water Resources and Alameda County to ensure adequate funding for dam inspections and emergency response in the event of dam failure.
- Establishing flood hazard areas based on flood hazard maps produced by FEMA or other sources.
- Obtaining funding for ongoing flood risk abatement programs.
- Providing education to floodplain residents about flood preparedness and the resources available before and after floods.
- Using natural and green infrastructure to reduce flood risks and improve groundwater infiltration.
- Maintaining existing floodplain-compatible uses such as agriculture and open space.

²⁵ City of Livermore, 2019. *Community Services and Infrastructure Report*.

²⁶ City of Livermore, 2021. *Draft Storm Drain Master Plan 2021*. Drafted Dated August 31, 2021.

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