Chapter IV.

ENVIRONMENTAL HAZARDS

FLOODING AND HYDROLOGY ELEMENT

PURPOSE

The Flooding and Hydrology Element of the Apple Valley General Plan sets forth goals, policies, and programs to addresses potential drainage and flooding hazards within the community. The protection of the general health, safety and welfare of the community from potential flood and associated hazards is the primary goal of this Element. Further, other elements of the General Plan, which also address threats to the lives and property of the community's residents, are referenced in this Element, and the potential for and extent of major future flooding are assessed. The Town intends to plan for and implement the phased development of project-specific and Town-wide flood control facilities.

BACKGROUND

There are several General Plan Elements that are related to the Flooding and Hydrology Element. These include the Circulation Element, which discusses the need to maintain adequate access and evacuation routes in the event of a major flood or other disaster; the Geotechnical Element and the potential for seismic hazards to rupture aboveground water storage tanks; and the Hazardous and Toxic Materials Element, addressing the transport and storage of hazardous and toxic liquids above and below ground. In addition, the policies and programs of the Land Use Element guide the location of development, key public facilities, and open space, which each have the ability to affect flood damage potential.

General Plans are required by state policies and regulations to offer mitigation measures to lower the impacts associated with the potential flood hazards within a community. California Statute 1939, Chapter 73, mandates that area-wide drainage affecting local jurisdictions be subject to joint planning. Further, the Cobey-Alquist Flood Plain Management Act (Government Code Section 8401c) requires that local governments plan, adopt, and enforce land use regulations for flood plain management. This Act also establishes requirements for receiving state financial assistance for flood control measures. Finally, the mapping of areas subject to inundation in the event of dam failures is required by California Government Code Section 8589.5 and 65302 (g).

Meteorological Setting

There are three types of storms that produce precipitation that have the potential to impact the Apple Valley area: winter storms, local thunderstorms, and summer tropical storms. Winter storms are characterized by heavy and sometimes prolonged precipitation over a large area. These storms usually occur between November and April, and are responsible for most of the precipitation recorded in Apple Valley and southern California. Local thunderstorms can occur at any time, but usually impact relatively small areas. These storms are typically most prevalent in the higher mountains during the summer, but are also common in the Mojave Desert region. Tropical rains typically occur in the summer or early fall, especially in desert areas. These storms

originate in the warm, southern waters off Baja California, in the Pacific Ocean, and move northward into southern California.

Precipitation in southern California is also extremely variable from year to year, ranging from a fraction of the average amount in one year, to more than double the average amount in another. The Town of Apple Valley and surrounding areas are, like most of southern California, subject to unpredictable seasonal rainfall. Most years, the scant winter rains are barely sufficient to turn the hills green for a few weeks, but every few years the region is subjected to periods of intense and sustained precipitation that results in flooding.

For example, record-breaking rainfall has occurred periodically in Apple Valley with peak flows typically ranging from about 500 to 1,000 cubic feet per second. However, record peak flows (measured just upstream of the Mojave Forks Dam) reached about 23,000 cubic feet per second in 1969 and 1978, and more than 37,000 cubic feet per second in 1910. During the winter of 1938 peak stream flow for Deep Creek was estimated at more than 46,000 cubic feet per second, and the Mojave River swelled to more than 70,000 cubic feet per second. The winter rainfall in February and March of 1938 remains the benchmark for damaging storms in the Apple Valley area.

General Conditions and Flood Hazards

Floods are natural and recurring events that only become hazardous when man encroaches onto floodplains, modifying the landscape and building structures in the areas meant to convey excess water during floods. Unfortunately, floodplains have been attractive to development throughout history, since they provide level ground and fertile soils suitable for agriculture, as well as access to water supplies and transportation routes. However, flood hazards are one of the most destructive natural hazards in the world, responsible for more deaths per year than any other geologic hazard. In addition, the average annual monetary flood losses have increased steadily over the last decades as development in floodplains has increased.

As the population in the area increases, there is an increased pressure to build on flood-prone areas, and in areas upstream of previously developed land. The construction of impervious surfaces, such as asphalt, associated with increased development means that water that used to be absorbed into the ground becomes runoff to downstream areas. Areas that have not flooded in the past may be subject to flooding in the future if drainage channels that convey storm waters are not designed or improved to carry these increased flows. Developments near the base of the mountains and downstream from canyons that have the potential to convey mudflows are particularly susceptible.

Stream Flow and Flood Hazard

Most of the drainages from the surrounding hills and mountains in Apple Valley terminate in desert playas (dry lakes). The Apple Valley Dry Lake is the largest playa in the area, collecting runoff from most of Apple Valley. A smaller playa (Reeves Dry Lake) is present in the central part of Fairview Valley, where it receives runoff from the adjacent mountains. In the southeast corner of Apple Valley, drainages from the Ord Mountains, including the Juniper Flats, Arrastre

Canyon, and Lovelace Canyon watersheds, lead to Rabbit Dry Lake in Fifteenmile Valley. Along the eastern edge of the Sphere of Influence, drainages from the Granite Mountains flow eastward to Lucerne Dry Lake in Lucerne Valley. Drainage channels in Apple Valley's local mountains are well carved, however they lose their strong definition upon reaching the valley floor, where sediment-laden water typically spreads out into braided ephemeral stream channels and as sheet flow.

Drainages along the western side of Apple Valley eventually discharge into the Mojave River. The largest tributary to the Mojave River within Apple Valley is Bell Mountain Wash, a natural channel that collects runoff primarily in the area north and west of Bell Mountain. The area west of Catholic Hill is drained by the smaller, partially modified, Desert Knolls Wash. In the southwest corner of Apple Valley, numerous small, unnamed drainages draining the western part of the Ord Mountains flow towards the Mojave River.

The Apple Valley Master Plan of Drainage reports several episodes of flooding including a 20-minute storm in August 1961 that caused several homes near Bell Mountain to be inundated by mud flows, a two-hour summer storm in 1963 that caused flash flood waters to inundate downtown sections of Apple Valley, and a 45-minute storm in August 1974 that flooded streets, homes, and businesses throughout the area. More recently, in January 2005, intense and sustained rainfall in the San Bernardino Mountains caused the release of water impounded behind Cedar Springs Dam (Silverwood Lake) and Mojave Forks Dam, leading to evacuations and flooding downstream, as well as erosion of the earthen levees along the Mojave River.

Seismically Induced Inundation

Dam Inundation

Seismically induced inundation refers to flooding that results when water retention structures, such as dams, fail due to an earthquake. Three dams in the area could potentially impact Apple Valley and the surrounding communities. These include the Mojave Forks Dam (Mojave Reservoir), the Cedar Springs Dam (Silverwood Lake), and the Lake Arrowhead Dam.

Mojave Forks Dam is located at the base of the San Bernardino Mountains, where Deep Creek and the West Fork of the Mojave River merge to form the Mojave River. Constructed in 1971 to control flooding in desert communities downstream along the river, the dam consists of an embankment that is 200 feet higher than the original streambed and is constructed of compacted fill. The reservoir design flood is a peak outflow of 23,500 cubic feet per second, and 131,300 cubic feet per second for the spillway. The maximum release from the dam to date was 16,600 cubic feet per second in January 2005. A worst-case scenario from failure of the Mojave Forks Dam is that floodwaters would be expected to be confined to the existing Mojave Riverbed and the mouths of tributary channels.

Cedar Springs Dam is located in the Summit Valley area of Hesperia, upstream from the Mojave Forks Dam. This dam is constructed across the West Fork of the Mojave River and impounds the Silverwood Lake, a large water supply reservoir that also serves as a recreation facility. The dam captures a thirty-four square mile drainage area. If the Cedar Springs Dam failed it is

expected that it would flood a significant portion of eastern Summit Valley between Silverwood Lake and Mojave Forks Dam in less than 30 minutes.

Lake Arrowhead Dam is located at an elevation of approximately 5,000 feet, approximately15 miles south of Apple Valley in the San Bernardino Mountain. The dam was constructed over a period of years beginning in 1893; subsequent legal delays slowed construction, and the dam opened in 1922. Lake Arrowhead Dam encompasses approximately 780 acres and has an average depth of 100 feet. In the event of dam failure, floodwaters would flow north down the Deep Creek drainage to the Mojave Forks Dam, and would be contained in the Mojave Forks Reservoir area. If the Mojave Forks facility were at or near capacity, however, water from Lake Arrowhead would spill over into the Mojave River.

Inundation from Above-Ground Storage Tanks

Strong ground shaking and rupture can damage aboveground water tanks. Without adequate bracing and baffling, seismically induced inundation can occur. As a result, sloshing water within the tank can potentially lift the tank off of its foundation and split the shell. The Town of Apple Valley does not provide water to its residents, and does not own any water reservoirs. There are numerous private water companies providing the area with water, and also maintaining aboveground water reservoirs within the Town. Most of the tanks have been constructed in recent years and may meet current earthquake design standards. However, older tanks may lack the flexible joints and other seismic upgrades. Such upgrades, associated with newer design requirements, can help to limit the potential for damage to areas downstream resulting from a failed water tank. Therefore, evaluation and retrofitting of existing tanks within the Town should be undertaken as necessary to ensure compliance with the most current water tank design criteria.

FLOOD CONTROL MEASURES

Regional Flood Control

The management of regional drainage within and in the vicinity of Apple Valley is the responsibility of the San Bernardino Flood Control District. Regional drainage includes rivers, major streams and their tributaries, as well as areas of significant sheet flows. The District is mandated to provide flood control planning and construction of drainage improvements for regional flood control facilities, as well as watershed and watercourse protection related to those facilities as part of its broad management functions. In order to accomplish its responsibilities, the District has been invested with the power of taxation bonded indebtedness, land and water rights acquisition, and cooperative partnerships with local, state, and federal agencies. The official decision-making body for the District is the San Bernardino County Board of Supervisors.

Local Flood Control

Although as stated above the San Bernardino County Flood Control District has the primary responsibility for managing regional drainage in and around the community, the Town remains directly responsible for the management of local drainage. To manage local drainage and open

space, areas rich in vegetation and cover, as well as those constrained by topography should be preserved, so as to allow existing alluvial plains and drainage channels to reduce runoff and preserve the capacity of downstream facilities. The size of downstream facilities required can be significantly reduced through the inclusion of on-site stormwater detention facilities significantly. Further, such planning provides opportunities for groundwater recharge as well as enhanced open space and/or recreation areas.

As new developments are considered within the Town, hydrologic studies should be conducted to evaluate the impact that increased development may have on existing downslope development The hydrologic analyses should consider the effects of increased runoff and alterations to natural stream courses and identify the constraints to be assessed while planning and site development are in their earliest stages. If any deficiencies are identified in the project hydrologic study, the project proponent needs to demonstrate that these can be mitigated to a satisfactory level prior to proceeding forward with the project, in accordance with California Environmental Quality Act (CEQA) guidelines. Typical mitigation measures used to address hydrologic deficiencies in project design include the provision of flood control devices such as catch basins, storm drain pipelines, culverts, detention basins, desilting basins, velocity reducers, as well as debris basins for protection from mud and debris flows

The San Bernardino County Flood Control District has established methodology to be used to analyze and design flood control structures. The Town is responsible for operation of the local storm drain network, whereas the regional flood control facilities are the responsibility of the San Bernardino County Flood Control District. As a result, both agencies must be involved in the planning and approval of mitigation measures in order to assure compatibility. The scale, complexity and cost of future flood control facilities is influenced by the effectiveness with which drainage issues are managed within Apple Valley. Prevention and on-site management that recognize the significant physical and financial constraints that exist in many parts of the planning area should be actively integrated into community land use planning and regulation.

Apple Valley Master Plans of Drainage

The drainage within the Town of Apple Valley is defined by the Apple Valley Master Plan of Drainage and the Apple Valley West/Desert Knolls Master Plan of Drainage.

Apple Valley Master Plan of Drainage[2]
The Apple Valley Master Plan of Drainage divides the Town of Apple into subareas based on localized hydrologic features, including topography, soils, and drainage facilities. These subareas include the North Community, the South Community, and the East Community, as discussed below.

The North Community Master Drainage Plan identifies numerous drainage courses and regional drainage facilities in the northern part of Town, north of the Apple Valley Dry Lake. The existing and proposed flood control facilities in this area include:

[2] "Apple Valley Master Plan of Drainage," prepared by San Bernardino County Flood Control District, 1991.

- Facility N-01 is an unimproved, open channel that collects runoff from a 3.3 square mile area encompassing Fairview Mountain and is diffused on the valley floor. This channel intercepts runoff and provides flood protection for buildings east of Central Road.

- Facility N-02 is a shallow earthen channel adjacent to the Apple Valley Airport that runs through from Central Road (north of Johnson) to Waalew Road (west of Navajo Road). Runoff transported by Facility N-02 originates on the south side of Black Mountain and the northeast side of Fairview Mountain, collecting runoff from an 8.7 square mile area.

- Facility N-03 is a riprap-lined channel that transports runoff from an industrial area east of the airport, and merges with facility N-02 south of Papago Road.

- Facility N04 is a fully leveed channel that conveys runoff southward from Black Mountain, north of the Mojave Northern Railroad. The channel drains an area of 7.6 square miles. A debris basin is recommended adjacent to the railroad, because upstream of the railroad lines there are many drainage paths through the Black Mountain area.

- Facility N-05 is an earthen channel with a partial riprap lining that transports runoff generated entirely from the industrial area north of the airport. It merges with channel N-04 just south of Gustine Street, where an earthen levee collects flows.

- Facility N-06 carries runoff generated by Bell Mountain, Little Bell Mountain, and Catholic Hill, west of Dale Evans Parkway between Quarry Road and Corwin Road. The channel drains 1.6 square miles and is a natural earthen channel in some areas, has riprap in other sections, and is fully leveed in its southernmost sections. Containment levees are needed on the east side of the upper portions of the channel. In addition, debris basins may be required, since the natural channels that drain Bell Mountain are intercepted.

- Facility N-07 is a riprap-lined channel that carries runoff from Little Bell Mountain and Catholic Hill. This channel runs parallel with Corwin Road and merges with channel N-06 at the intersection of Corwin Road and Papago Road. This facility requires a containment levee along Corwin Road to channelize flows, and a debris basin where the natural channels that drain Catholic Hill are intercepted.

The South Community Master Drainage Plan proposes drainage courses and regional drainage facilities in the southern part of Town, south of the Apple Valley Dry Lake. The existing and proposed flood control facilities in this area include:

- Facility S-01 (Mariana Wash) and its tributaries, which convey most of the initial runoff from the Ord Mountains within the watershed. This facility's outlet is at the Apple Valley Dry Lake, with 100-year peak flows of approximately 9,900 cubic feet per second and a tributary area of about 29 miles. It may be beneficial to elevate the lower reaches of this facility as a rectangular concrete channel to reduce impact on existing development.

- Facility S-02 conveys runoff from the residential area south of the railroad and north of Ocotillo Way. The alignment of this facility closely follows the alignment of the existing wash. This facility outlets to Facility S-01, just south of Ramona Avenue with a 100-year peak flow rate of approximately 5,200 cubic feet per second. This drainage has a tributary area of about 9 square miles.

- Facility S-03 conveys runoff from the Ord Mountains east of the portion that is directly tributary to Facility S-01. At its confluence with S-01, this facility has a peak 100-year flow rate of approximately 3,800 cubic feet per second, and a 5.5 square mile tributary area.

- Facility S-04 conveys runoff originating in the Ord Mountains west of the portion contributing directly to S-01. At its confluence with S-01, this facility has a peak 100-year flow rate of approximately 2,100 cubic feet per second, and a 2.1 square mile tributary area.

- Facility S-05 would be constructed to convey runoff from the single-family residential development south of the railroad. This channel will have a base of 15 feet in width and a riprap lining for its entire 200-foot length. The 100-year peak flow for this facility is estimated to be approximately 780 cubic feet per second.

- Facility S-06 is proposed to follow the existing alignment of Colony wash, and would convey runoff from Deadman Hills and the low-density residential area in the southeast portion of the Town. At its confluence with S-02, this facility would have a peak 100-year flow of approximately 3,100 cubic feet per second, and a 4.4 square mile tributary area.

- Facility S-07's alignment is proposed to closely follow the existing Del Oro Wash for its entire length. It will convey runoff from local residential areas encompassing 2.4 square miles and will have a peak 100-year flow rate of 1,600 cubic feet per second at its outlet to S-03.

- Facility S-08 conveys runoff from a southwest portion of Town to the Apple Valley Dry Lake. The watershed is long and narrow, and includes dense development of single-family homes. At this facility's outlet to the Dry Lake, the 100-year peak flow rate is approximately 2,800 cubic feet per second, with a 7.4-mile tributary area.

- Facility S-09 conveys runoff from the southwest portion of Town and outlets to S-08, just north of Standing Rock Avenue and east of Navajo Road. The 100-year peak flow rate is approximately 1,100 cubic feet per second, with a 2.8-mile square mile tributary area.

- Facility S-10 conveys runoff from the area immediately west of the Apple Valley Dry Lake. At this channel's outlet to the Dry Lake, the 100-year peak flow rate is about 1,100 cubic feet per second, and it has a 1.2 square mile area of contribution.

The East Community Master Drainage Plan proposes drainage courses and regional drainage facilities in the eastern part of Town. There are no significant man made flood control facilities in the East Community, and the natural drainage system consists of one major watercourse, which is the Fairview Wash. The existing and proposed flood control facilities in this area include:

- Facility E-01 is known as the Fairview Wash. Runoff is generated from the Granite Mountains in the east and south, and from the Fairview Mountains to the north. This runoff is contained within a broad flood plain with side slopes with a ratio of approximately 60 to 1. This channel outlets to the Apple Valley Dry Lake, with 100-year peak flows of 8,500 cubic feet per second, and a tributary area of approximately 20 square miles.

- Facility E-02 is planned to meet with E-01 at the outlet to the Dry Lake. Runoff for this facility is generated from Fairview Mountain north of Waalew Road. Runoff will be collected into a concrete channel by means of an earthen levee along the north side of Waalew Road, east of Tokata Road, as well as a short section of levee running north on the west side of the natural watercourse. The 100-year peak flow is expected to be about 1,400 cubic feet per second, with a 1.5-mile tributary area.

- Facility E-03 drains the southern portion of Fairview Mountain in a partially riprap lined channel with a base of 15 feet. This facility has a 100-year peak flow rate of approximately 840 cubic feet per second. The facility's confluence with E-01 occurs approximately 1,200 feet east of Japatul Road.

- Facility E-04 conveys runoff from the western portion of the Granite Mountains and the Deadman Hills. Runoff is channelized just north of Esaws Avenue, approximately 1,600 feet east of Japatul Road. The addition of a levee running southeast from the channel inlet, and another along the east side of Redwing Road, will ensure channelization of runoff. At its outlet into the Dry Lake, this facility has a 100-year peak flow of 5,700 cubic feet per second, from a 10.4 square mile tributary area.

- Facility E-05 conveys runoff from the Granite Mountains between Thunderbird Road and Standing Rock Avenue. The channel confluences with E-04 at Candlewood Road. The 100-year peak flow rate for this facility is 3,800 cubic feet per second, from a tributary area of 4 square miles.

- Facility E-06 conveys runoff from the Deadman Hills. It joins with E-04 approximately 750 feet north of Esaws Avenue and 500 feet west of Shirwaun Road. The 100-year peak flow for this facility is approximately 1,600 cubic feet per second.

- Facility E-07 conveys runoff from the Granite Mountains and Japatul Hills south of Standing Rock Avenue. This facility joins with E-05 at Shirwaun Road, and has a 100-year peak flow of 1,200 cubic feet per second. The channel is riprap lined with a base of 15 feet.

- Facility E-08 conveys runoff from the Granite Mountains between Thunderbird Road and Standing Rock Avenue. The riprap lined channel joins with E-05 at Via Vista Road just east of Lillian Way, with a 100-year peak flow rate of approximately 750 cubic feet per second.

Apple Valley West/Desert Knolls Master Plan of Drainage[3]
The Apple Valley West/Desert Knolls watershed is generally defined by Catholic Hill and Piercy Quarry to the north, the base of the Ord Mountains to the south, Kiowa Road to the east, and the Mojave River to the west. The watershed is long and narrow, with the northern portion moderately sloping to the southwest and the southern portion gently sloping down to the northwest to the Mojave River. The existing and proposed flood control facilities in this area include:

- Line A-01 is known as the "Desert Knolls Wash" and is an existing natural earthen channel that enters the Mojave River just upstream of the Upper Narrows. If levees are constructed on the River in this area, this facility would require approximately 500 feet of containment levees ranging from zero to six feet. The 100-year flow depth in this facility is the same as the River at their confluence.

- Line B-01 has a proposed outlet that will cross Riverside Drive and continue directly into the River. When River levees are constructed, this facility will require containment levees ranging from zero to six feet upstream to Talcony Road, approximately 1,200 feet upstream of Riverside Drive. The 100-year flow depth in this facility is approximately 3 feet higher than the River at their confluence.

- Line C-01 flows across Havasu Road and empties into an earthen swale that flows to the northwest and into the River. Construction of the River levees will require containment levees at this facility, ranging from zero to six feet upstream to Havasu Road. The 100-year flow depth in this facility is the same as the River at their confluence.

- Line E-01 is proposed to utilize existing pits between the railroad and Rock Springs Road. The pits will need to be filled approximately 10 feet and the River levee will have to be lowered to allow flows to reach the River. The railroad and road embankments will act as levees for this facility. With these improvements, the 100-year flow depth of this facility is approximately 4 feet higher than the River at their confluence.

Federal Emergency Management Agency and Federal Flood Rate Maps

The Federal Emergency Management Agency (FEMA) is required to assess flood hazards, as mandated by the National Flood Insurance Act (1963) and the Flood Disaster Protection Act (1973). Through the National Flood Insurance Program (NFIP), FEMA conducts engineering studies to assist communities in evaluating the extent and location of flood hazards, and to encourage appropriate land use and flood plain management and development. The flood zones mapped by FEMA are published in Flood Insurance Rate Maps (FIRMs). The extent of flooding

[3] "Apple Valley Master Plan of Drainage," prepared by San Bernardino County Flood Control District, 1991.

potential in some parts of Apple Valley has been analyzed through Flood Insurance Studies. Exhibit IV-4, Flood Zones in the Study Area, shows the FIRM inundation limits for the 100-year and 500-year flood in the planning area. It should be noted that mapping of flood zones is not complete since the entire area was not studied.

FEMA defines the flood zones based on the potential level of inundation. Each of the applicable flood zones is briefly described below.

Zone A: Areas of 100-year flood for which no base flood elevations have been determined.

Zone AE: Areas of 100-year flood for which base flood elevations have been determined.

Zone D: Areas in which flood hazards have not been determined.

Zone X: Areas that have been determined to be outside the 500-year floodplains.

The FIRM maps are amended periodically to reflect changes in flood control facilities and/or changes in topography (usually as a result of development). Modifications to the FIRM maps typically accompany updated Flood Insurance Studies or Letters of Map Change that FEMA issues in response to an agency supplying new hydraulic data showing that the flooding hazard in a specific area has changed or been abated. FIRM maps in the Town include six community panels from 1996, and one community panel form 1997. Since their original publication, some of the maps have been amended by Letters of Map Change.

Portions of Apple Valley are still vulnerable to inundation during the 100-year flood. These areas occur along the Mojave River and Desert Knolls Wash, and within the Apple Valley Dry Lake.

Except for Desert Knolls Wash, most of the FEMA flood-prone areas are relatively undeveloped, or in the case of Apple Valley Dry Lake, development is minimal. Rock Springs Road is a major roadway and Mojave River crossing in the planning area. This roadway, as well as numerous secondary roads (mostly in the Dry Lake area), would be flooded and impassable as a result of the 100-year storm.

Land Use Planning as a Flood Control Strategy

One of the most effective and direct methods to control flooding and limit threats to lives and property is land use planning. Proper planning is consistent with other primary community goals that call for the preservation of natural areas in the foothills and mountains. These preserved areas can function as natural watersheds for local drainage and ground water recharge and can have positive affects by slowing down storm water flows and reducing erosion and the amount of debris that reaches downstream facilities.

Land use planning can also limit human exposure to the hazards of flooding. Losses to the community can be greatly reduced through the use of restrictions on the type and location of structures in the vicinity of major drainages. Within the limits of improved and unimproved 100-year floodplains development should be severely limited and regulated. Restrictions in the Apple

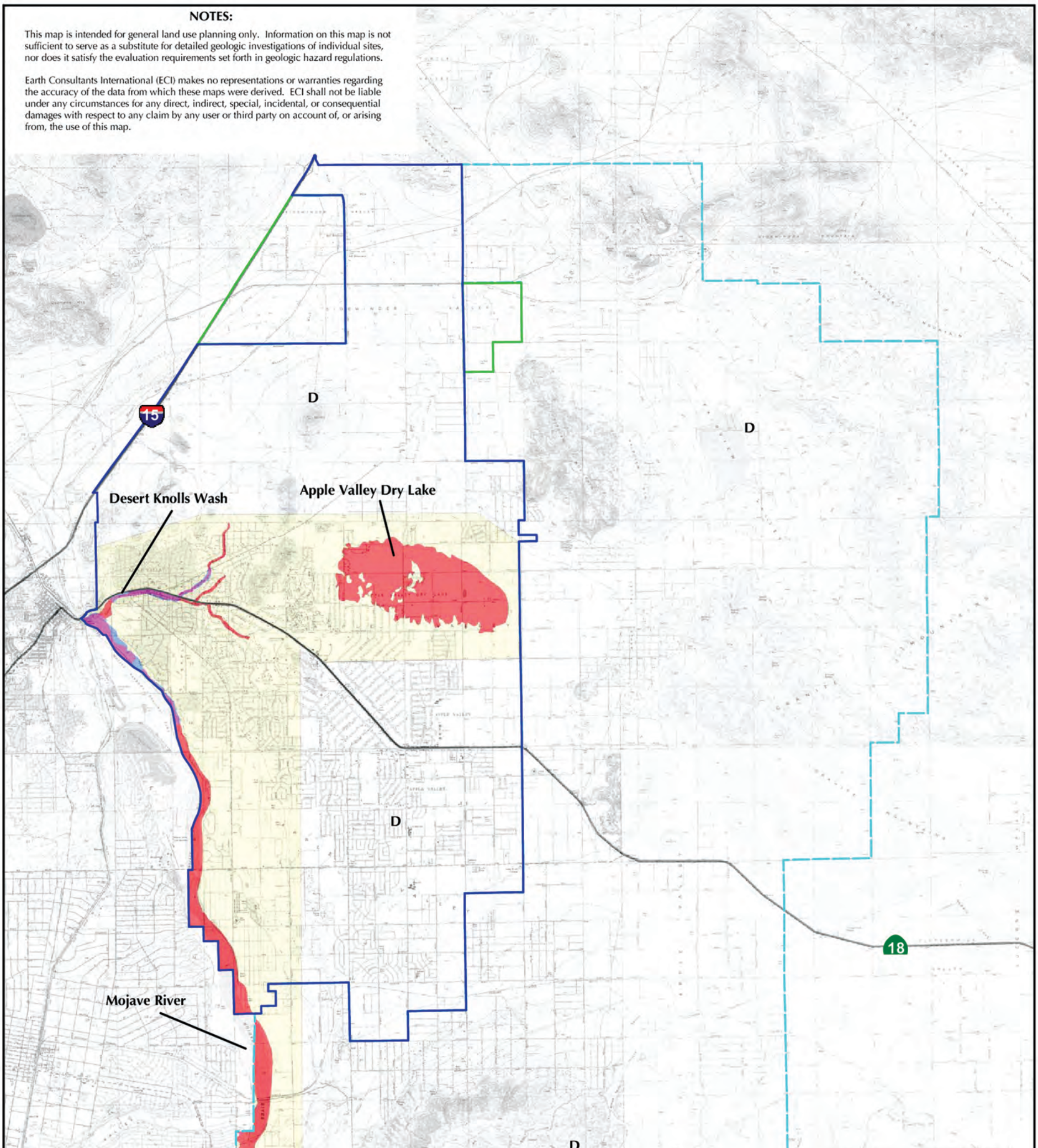
Valley Dry Lake, which allows development of one unit on every 5 acres, or prohibitions on development if flood hazards cannot be eliminated, are examples of how planning can effectively protect against flooding.

Development approvals should be conditioned to assure protection of improvements from flood damage within flood zones subject to sheet flooding. Protection measures may include the raising of buildings' finished floor levels above the flood depth projected for the surrounding area, and providing protection to drainages against scouring. Such measures are standard requirements of the San Bernardino County Flood Control District and the Town, for all projects proposed in FEMA Zone A (see discussion of FEMA Zones, above). Until such time as flood improvements are completed, and flood prone areas are removed from severe threats of flooding, development in these areas should be carefully regulated.

NOTES:

This map is intended for general land use planning only. Information on this map is not sufficient to serve as a substitute for detailed geologic investigations of individual sites, nor does it satisfy the evaluation requirements set forth in geologic hazard regulations.

Earth Consultants International (ECI) makes no representations or warranties regarding the accuracy of the data from which these maps were derived. ECI shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to any claim by any user or third party on account of, or arising from, the use of this map.



Base Map: USGS Topographic Map from Sure!MAPS RASTER, 1997.
Sources: Federal Emergency Management Agency, 1997; 1996, 1997 (Flood Insurance Rate Maps
Panel Numbers: 06071C6485F, 06071C5845F, 06071C5840F, 06071C5820F, 06071C6505F, and 06071C6515G).

N
W E
S

Scale: 1:108,000

9000 0 9000
Feet

2000 0 2000
Meters

Explanation

- A — Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
- AE — Areas of 100-year flood; base flood elevations and flood hazard factors determined.
- X — Areas of 500-year flood; areas of 100-year flood with average depths of less than one foot or with drainage areas less than one square mile and areas protected by levees from 100-year flood.
- X — Areas determined to be outside the 500-year floodplain.
- D — Areas in which flood hazards are undetermined.
- Town of Apple Valley Boundary
- Apple Valley Sphere of Influence
- Apple Valley Annexed Area

Source: Earth Consultants International, December 2008

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Apple Valley General Plan
Flood Zones in the Study Area
Apple Valley, California

Exhibit
IV-4

Flood Protection Measures for Property Owners

Within the vicinity of the Mojave River and the Apple Valley Dry Lake, flooding remains a significant risk to structures and residents in Town. It is recommended that property owners in flood prone areas make modifications to their houses to reduce the potential impacts of flooding. Flood protection measures are recommended by FEMA for property owners to implement and reduce flood damage, including: the installation of waterproof veneers on the exterior walls of buildings; putting seals on all openings, including doors, to prevent the entry of water; raising electrical components above the anticipated water level; and installing backflow valves that prevent sewage from backing up into the house through the drainpipes. These suggested improvements vary in complexity and cost, and some need to be carried out only by a professional licensed contractor. Structural modifications require a permit from the Apple Valley Building and Safety Division, or the County Building Departments. These agencies should be consulted regarding whether or not flood protection measures would be appropriate for a specific property.

Other Flood Control Measures

Emergency Response

The Town has established the following evacuation routes: Central Road (north/south), State Route 18 (east/west and north/south), and Bear Valley Road (east/west). The County is currently developing County Evacuation/Transportation Committee within each region, with the high desert region plan expected to be addressed in early 2009. Town emergency services staff regularly participate in the County Evacuation/Transportation Committee and attend Caltrans training. As of 2008, no comprehensive mass evacuation plan is in place for the Town or the region.

In order to provide the highest functional reliability of major roadways and the public transportation system serving the Town and the region, the Town shall continue to coordinate with Caltrans, the Federal Highway Administration, adjoining cities and communities, and San Bernardino County. The Town shall also address flooding hazards that threaten people and property, and that may isolate portions of the community, through continued coordination with San Bernardino County Flood Control and FEMA. Through this coordinated effort, programs should be developed that can identify and address weak links in the circulation system, in conjunction with the efforts of the County and other jurisdictions in the high desert region.

All Weather Crossings

U.S. Interstate-15 and State Route 18 are major regional access routes serving the Town. Bridges and underpasses are critical roadway components for delivery of food, water and medical supplies and personnel, as well as for the evacuation of the injured. Freeway underpasses and railroad crossings are generally protected from flooding by existing flood control structures. In the event of a major flood or other disaster, critical roadways and components could be damaged or blocked.

In the event of major flood events, access to the U.S. Interstate-15 freeway, which links Apple Valley with other cities and communities in the region, may become flooded or damaged. However, several roadways cross the Mojave River west of the Town, including Interstate-15, State Route 18, Bear Valley Road and Rock Springs Road. Rock Springs Road is an at-grade roadway that is not passable during moderate to heavy rainfall. Although funding for realignment of this roadway has been authorized through Proposition 1.B (Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act of 2006), these improvements do not address the river crossing. An additional crossing, the Yucca Loma Bridge at Yucca Loma Road, is under design by the Town, and construction is anticipated to begin in 2010, with completion likely in the later part of 2011.

Based on information provided by Caltrans, all bridges on U.S. Interstate-15 in the planning area are designed to withstand the 100-year flood and to have 2 feet of freeboard for the 50-year flood.

The National Pollution Discharge Elimination System

The Clean Water Act was passed in 1972 with the goal of restoring and maintaining water quality by reducing "point source pollution" such as pollutants from industry and sewage treatment facilities. Amended in 1987, the Act's focus was shifted to polluted runoff; states were required to reduce discharges into waterways. The US Environmental Protection Agency (EPA) was required to formally regulate polluted runoff through the same mechanism by which it regulates industry and sewage treatment plants: with permits under the National Pollutant Discharge Elimination System (NPDES). Under the NPDES program, communities with populations exceeding 100,000 must apply for a municipal permit that require cities and counties to eliminate or control "non-point source pollution." As defined by the EPA, non-point source pollution is pollution from diffuse sources, such as contaminated runoff, that affect a water body.

The NPDES program emphasizes pollution prevention, control measure activities, utilization of existing resources and programs, and coordination with regional and state compliance activities. The goals of these activities include the following:

- Eliminate illicit connections and illegal discharges to the storm drain system;
- Promote public awareness and participation through the Program's education program, the Storm Water/Clean Water Protection Program;
- Identify and control storm water pollution created by industrial and commercial activities;
- Establish storm water management programs for public agencies to reduce the amount of pollutants that enter and accumulate in storm drains;
- Identify and establish local regulatory control measures for activities that can pollute the storm drain system, such as new development and construction, and residential, commercial and industrial activities;

- Monitor wet and dry weather flows to identify the origin, types, and concentrations of non-point source pollutants;

- Increase existing municipal efforts to clean streets, collect solid waste, and prevent used oil and other hazardous wastes from entering storm drains;

- Develop local ordinances to establish legal authority for cities and counties to regulate stormwater discharges.

In California, as in many other states, the NPDES permitting program is administered by the state rather than the EPA. There are nine Regional Water Quality Control Boards in California with administrative responsibility for the program. San Bernardino County is under the jurisdiction of the Santa Ana Regional Water Quality Control Board.

Flood Control, Wildlife Habitat and Recreation Enhancement

The control of storm water flows, which is consistent with the goals and policies set forth below, should also be viewed as an opportunity for multiple uses, including recreation and wildlife enhancement. This multi-use function should be considered in the design of washes, detention/retention basins and channels. The Biological Resources Element also supports these goals, and should be considered in tandem with the policies and programs in this Element.

Frequently used by numerous birds and small and large mammals, these facilities provide a source of forage and cover. They can also can offer meaningful areas for passive enjoyment by community residents, and serve as a retreat from the more urban environments of the area. These areas are also important as opportunities for the continued integration of the natural habitat into the built environment.

FUTURE DIRECTIONS

The principal implementation of this Element will be accomplished through the enforcement and implementation of the Apple Valley Master Plan of Drainage and the Apple Valley West/Desert Knolls Master Plan of Drainage. The improvements associated with the Master Drainage Plans will help control and confine the area-wide drainage pattern to more discreet and focused routes where it can be better managed. The Master Plans identify facilities that complement land use patterns, provide cost-effective flood control alternatives, and maximize opportunities for multiple uses. The Master Plans also set critical parameters for future development along areas subject to area-wide flooding. The Apple Valley Development Code, Grading Ordinance, and Subdivision Ordinance will be the primary tools the Town will use to implement the flood protection measures required in the Master Plans. An update to the Master Plan of Drainage is currently being drafted in cooperation with the County of San Bernardino Flood Control District and is anticipated to be completed by 2011 or earlier.

GOAL, POLICIES AND PROGRAMS

Goal

Protect lives and property from flooding hazards through a comprehensive system of flood control facilities throughout the Town.

Policy 1.A
Upgrade the Town's local and regional drainage system through proactive planning and coordination with other responsible agencies.

Program 1.A.1
Implement the recommendations of the 1991 Apple Valley Master Plan of Drainage and the 1994 Apple Valley West/Desert Knolls Master Plan of Drainage.
Responsible Agency: Public Works Division, Planning Division, Town Engineer, San Bernardino County Flood Control District
Schedule: Ongoing

Program1.A.2
Capital Improvement Plans outlined in the Apple Valley Master Plans for Drainage for drainage management and control shall be updated and maintained.
Responsible Agencies: Public Works Division, Planning Division, Town Engineer, San Bernardino County Flood Control District
Schedule: Ongoing

Program 1.A.3
Monitor the Master Plans of Drainage every five years, and amend them to reflect changes in local and regional drainage and flood conditions.
Responsible Agencies: Public Works Division, Planning Division, Town Engineer, San Bernardino County Flood Control District
Schedule: 2010-2011, every five years thereafter

Program 1.A.4
As part of project development, all new development shall be required to complete on site drainage improvements at their expense.
Responsible Agencies: Public Works Division, Planning Division, Town Engineer, San Bernardino County Flood Control District
Schedule: Ongoing

Policy 1.B
Consistent with their functional requirements, major drainage facilities shall be designed to maximize their use as multi-purpose recreational or open space sites. Major drainage facilities include the Mojave River, debris basins, the Apple Valley Dry Lake, and Master Plan flood control channels.

Program 1.B.1
Coordinate and cooperate with the San Bernardino County Flood Control District through multi-use agreements within flood control facilities and designing safe, attractive recreational facilities that maintain the functional requirements of the drainage facilities.
Responsible Agencies: Public Works Division, Planning Division, Community Services Division, Town Engineer, San Bernardino County Flood Control District
Schedule: Ongoing

Program 1.B.2
Continue active participation in regional flood control and drainage improvement efforts.
Responsible Agencies: Public Works Division, Planning Division, Town Engineer, San Bernardino County Flood Control District, Developers
Schedule: Ongoing

Policy 1.C
The Town shall actively cooperate with FEMA regarding amendments to local Flood Insurance Rate Maps, recognizing the importance of redesignation of the 100-year and 500-year flood plains within the Town boundaries as facility improvements are completed.

Program 1.C.1
Consistent with existing and proposed improvements in the Apple Valley Master Plans of Drainage, the Town shall coordinate and cooperate in the filing of appropriate FEMA application materials to incrementally secure amendments to the Flood Insurance Rate Maps for the Town in conjunction with the San Bernardino County Flood Control District.
Responsible Agencies: Public Works Division, Planning Division, Town Engineer, San Bernardino County Flood Control District
Schedule: Ongoing

Policy 1.D
All new development within the Town shall be required to incorporate adequate flood mitigation measures, including the adequate siting of structures located within flood plains, grading that prevents adverse drainage impacts to adjacent properties, and on-site retention of runoff.

Program 1.D.1
The retention of stormwater on a project site shall be enforced through the development review process and routine site inspection.
Responsible Agencies: Planning Division, Town Engineer
Schedule: Ongoing

Policy 1.E
Assure that adequate access is maintained during major storm events, and that safe all-weather crossings over drainage facilities and flood control channels are provided where necessary.

Program 1.E.1
Bridging of General Plan roadways within new development projects shall be the responsibility of the developer on whose project the bridge occurs and shall be included by the Town as a condition of project approval.
Responsible Agency: Public Works Division, Planning Division, Town Engineer, Planning Commission, Town Council
Schedule: Ongoing

Policy 1.F
Pursue all credible sources of funding for local and regional drainage improvements needed for adequate flood control protection.

Program 1.F.1
Consider the establishment of Fair Share Cost Allocations or Assessment Districts for purposes of funding necessary drainage improvements in particular geographic areas throughout Apple Valley.
Responsible Agencies: Public Works Division, Planning Division, Town Engineer, San Bernardino County Flood Control District, Developers
Schedule: Ongoing

Program 1.F.2
Explore state and county funding under the Cobey-Alquist Flood Plain Management Act and other state programs, as well as federal funding options for local and area-wide flood control projects.
Responsible Agencies: Public Works Division, Planning Division, Town Engineer, San Bernardino County, State of California
Schedule: Ongoing