4.3 WATER RESOURCES

4.3 WATER RESOURCES

This section describes the existing hydrological setting for the County, including a discussion of water quality, based on published and unpublished reports and data compiled by regional agencies. Agencies contacted include the United States Geological Survey, the California Department of Water Resources, and the Central Valley Regional Water Quality Control Board. This section also identifies impacts that may result from the project.

SETTING

CLIMATE

The local climate is considered warm desert receiving approximately six to eight inches of rainfall per year (U.S. Department of Agriculture, 1986). Rainfall occurs primarily in the winter months, with lesser amounts falling in late summer and fall. Kings County would also be considered a dry climate since evaporation greatly exceeds precipitation.[1] A common characteristic of dry climates, other than relatively small amounts of precipitation, is that the amount of precipitation received each year is highly variable. Generally, the lower the mean annual rainfall, the greater the year-to-year variability (Lutgens and Tarbuck, 1979).

SURFACE WATER HYDROLOGY

The County is part of a hydrologic system referred to as the Tulare Lake Basin (Figure 4.3-1). The management of water resources within the Tulare Lake Basin is a complex activity and is critical to the region's agricultural operations.

The County can be divided into three main hydrologic subareas: the northern alluvial fan and basin area (in the vicinity of the Kings, Kaweah, and Tule rivers and their distributaries), the Tulare Lake Zone, and the southwestern uplands (including the areas west of the California Aqueduct and Highway 5) (Figure 4.3-2).

The alluvial fan/basin subarea is characterized by southwest to south flowing rivers, creeks, and irrigation canal systems that convey surface water from the Sierra Nevada to the west toward the Tulare Lake Bed. The dominant hydrologic features in the alluvial fan/basin subarea are the Kings, Kaweah, and Tule rivers and their major distributaries.

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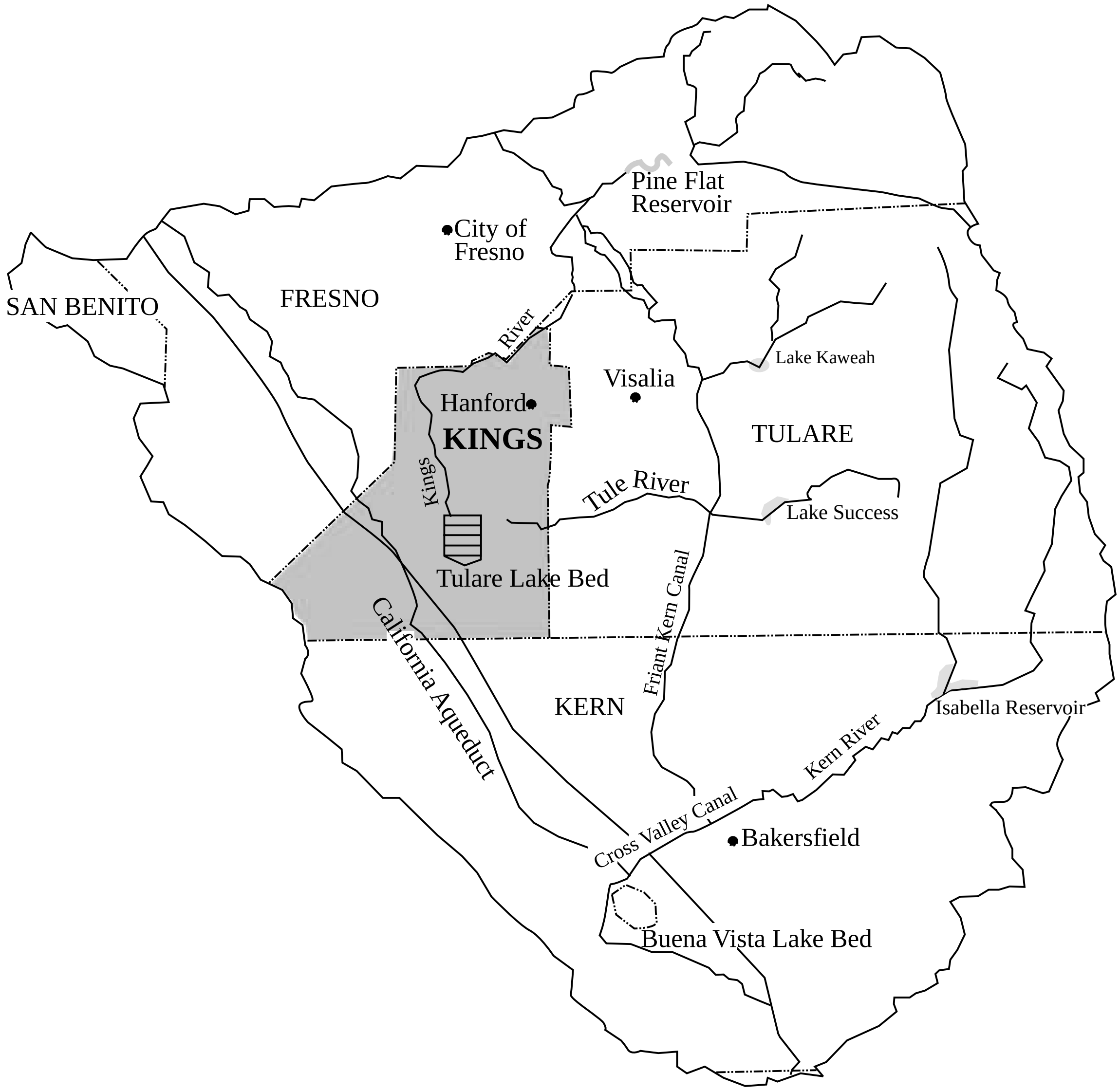
[1] The class "A" pan evaporation rate in an irrigated pasture environment is approximately 79 inches per year within the area of Kings County (California Department of Water Resources, 1979).

HYDROLOGY OF TULARE LAKE REGION Figure 4.3-1



Source: Modified from California Department of Water Resources, 1993, p.317.

BASELINE

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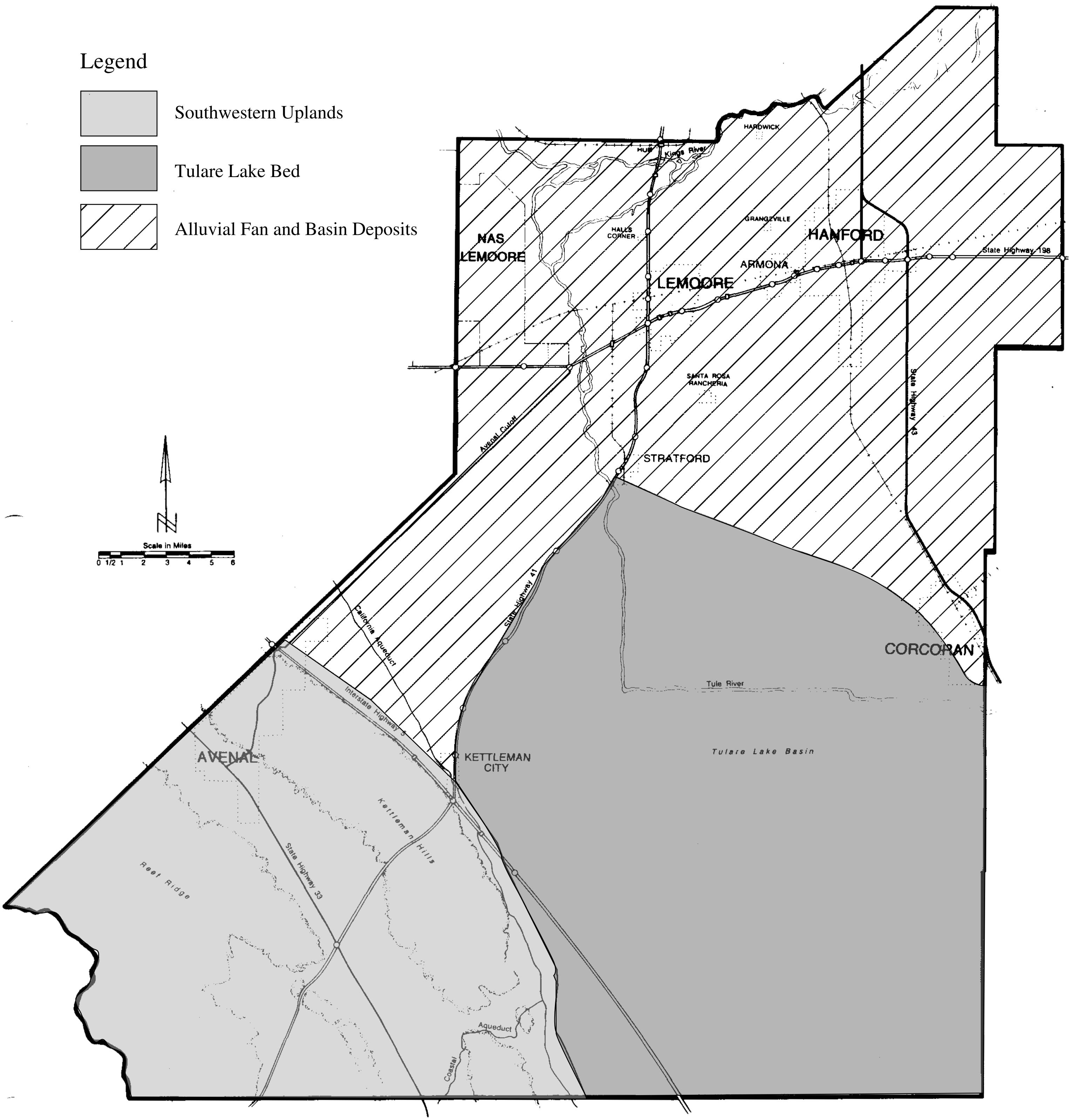
GROUNDWATER BASIN SUBAREAS **Figure 4.3-2**



BASELINE

The Kings River, which is the primary source of irrigation water for the area, is regulated by the Pine Flat Dam east of Fresno. The Kings River provides irrigation water to more than one million acres of agricultural land in Fresno, Tulare, and Kings counties (Kings County, 1993a).

Tulare Lake Bed is a remnant of a much larger Pleistocene lake that once occupied most of the basin (Bertoldi, et al., 1991). Historically, much of the southern San Joaquin Valley drained to the historic Tulare Lake Basin, and the basin remains one of internal drainage (i.e., no streams or rivers flow out of the basin). In the event of extreme rainfall and flooding of the basin, surface water would flow north from the basin to the San Joaquin River (RWQCB, 1995).

The southwestern upland area represents the eastern extension of the Coast Ranges into the valley, and is characterized by northwest to southeast trending valleys and ridges. The ridge tops within this subarea reach elevations of up to 3,500 feet National Geodetic Vertical Datum (NGVD) in the western portion of the County. In contrast, the lowest elevation of the lake bed is approximately 175 feet NGVD. In general, surface water drainage from the upland subarea flows toward the valley to the east.

Flooding

Portions of the County are located in the 100-year flood hazard area (Figure 4.3-3) as mapped by the Federal Emergency Management Agency (FEMA). The flood hazard areas are mainly along the Kings River and Cross Creek corridors and in the Tulare Lake Bed area.

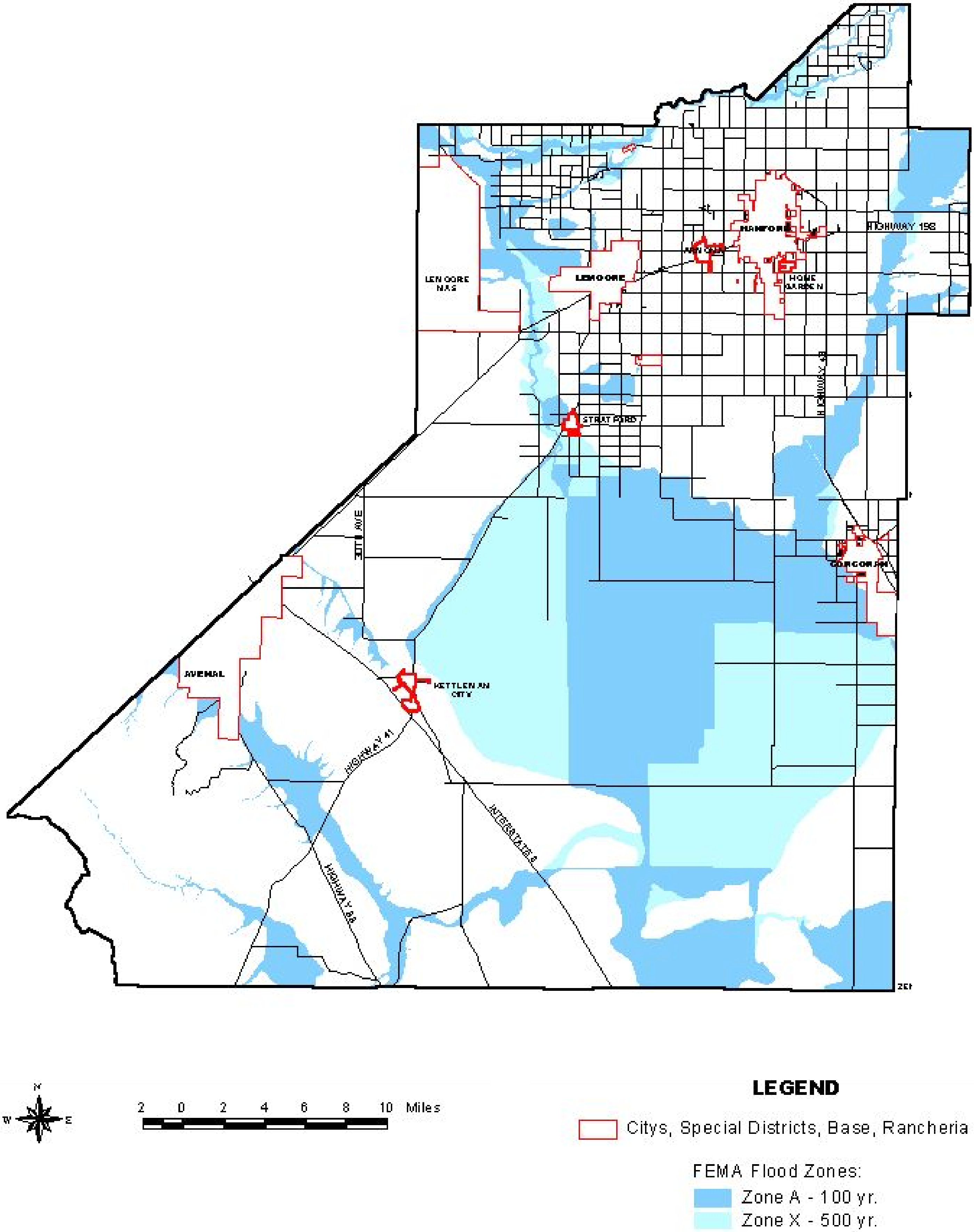
The County includes regions that are within the mapped flood inundation areas that would result from failure of Pine Flat Dam, Success Dam, and Terminus Dam, located to the northeast and east, respectively. In the event of a failure of any of these dams, flood waters would not reach the County line for hours (Kings County, 1993). The extremely low probability of the occurrence of dam failure, large volume of flood water available for dilution of potential pollutants, and the relatively long warning period to ready the dairy sites for flooding indicate that inundation related to dam failure would not be a significant impact of the project.

GROUNDWATER HYDROLOGY

The County can be divided into three groundwater subbasins, similar to the surface water hydrologic subareas discussed above, based on the hydrogeologic characteristics of the subsurface. The three subbasins include: 1) the northern alluvial fan and basin deposits, 2) the central and southeast lacustrine and marsh deposits (Tulare Lake Bed), and 3) the southwestern uplands (Figure 4.3-2).

FLOOD HAZARD ZONES

Figure 4.3-3



Source: Kings County Planning Agency, 2000.

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Alluvial Fan and Basin Deposits/Lacustrine and Marsh Deposits. The main difference between these two subbasins is the near-surface hydrogeology. The alluvial fan subbasin near-surface geology is characterized by a heterogeneous mixture of poorly sorted clay, silt, sand, and gravel, and in 1989, depth to first groundwater was measured to range from approximately 2.8 to 16.1 feet below the surface (Fujii, et al., 1995). The Tulare Lake Bed subbasin near-surface geology is characterized by silt and clay deposits with a minor amount of sand, and in 1989, depth to first groundwater was measured to range from approximately 2.2 to 9.0 feet below the surface (Fujii, et al., 1995).

In both subbasins, shallow groundwater (above a depth of approximately 250 to 900 feet above the E clay) occurs in unconfined[2] or semi-confined water-bearing zones, while deeper groundwater is confined. The shallow and deep aquifers are separated by the E clay, a laterally extensive clay layer within the Corcoran Clay Member of the Tulare Formation. The E clay is the most extensive lacustrine[3] clay in the entire Central Valley, covering an area of approximately 5,000 square miles (Page, 1986; Croft, 1972).

The shallow water-bearing zone is composed of alternating layers of silt, clay, and sand. Six of the most laterally extensive clay layers have been designated, from youngest to oldest, with the letters A through F (Croft, 1972). For the purposes of this discussion, the E clay, described above, is considered the bottom of the shallow water-bearing zone. Groundwater occurs at various depths within the shallow zone, since partially-confining clay layers or lenses occur throughout. In the Tulare Lake Bed subbasin, water levels were found to stabilize in wells installed to depths of 20, 56, 103, and 200 feet at 9.1, 15.7, 28.3, and 54.6 feet below the surface, respectively (Fujii, et al., 1995).

The deeper aquifer (below the E clay) is confined and, therefore, groundwater is under hydraulic pressure in this zone. Water rises up into wells installed in the deep aquifer to a level of approximately 150 to 200 feet below the ground surface (Kings County, 1993a).

Southwestern Uplands. In general, groundwater supplies are limited in the southwestern upland subarea. The relatively small valleys are isolated from surface water recharge; no major rivers or creeks flow through the subarea. In addition, the uplands are located on the eastern side of the Coast Range, and therefore experience a "rain shadow" effect. The area receives approximately six inches of rainfall per year (USDA, 1986), which does not provide a substantial amount of recharge to the aquifers in the isolated valleys (e.g., the

[2] An unconfined aquifer is one in which the surface of the water table is free to move up and down and is not "confined" by a low permeability soil or rock layer.

[3] "Lacustrine" clays were deposited on the bottom of a lake. In this case, the deposits are primarily composed of silt and clay with some sand layers.

Kettleman Plain and Sunflower Valley). Groundwater is typically more than 200 to 300 feet below the ground surface (DWR, 2000).

WATER QUALITY

The quality of surface and ground water at the project site is affected by land uses within the watershed and the composition of subsurface geologic materials. Water quality in surface and ground water bodies is regulated by the State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB). The County is under the jurisdiction of the Central Valley RWQCB, which is responsible for implementation of State and Federal water quality protection guidelines in the vicinity of the project site. The RWQCB implements the Water Quality Control Plan for the Tulare Lake Basin (Basin Plan) (California RWQCB, 1995), a master policy document for managing water quality issues in the region. The Basin Plan establishes beneficial water uses for waterways and water bodies within the region. Beneficial uses of surface waters in the Central Valley include water contact recreation, noncontact water recreation, industrial service supply, irrigation supply, navigation, shellfish harvesting, fishing, and preservation of rare and endangered species. Beneficial uses of the Tulare Lake Basin groundwater aquifer (the aquifer underlying the site) include municipal and domestic supply, industrial process supply, industrial service supply, agricultural supply, and wildlife habitat.

Surface Water Quality

The quality of runoff is regulated by the Federal National Pollutant Discharge Elimination System (NPDES) Nonpoint Source Program (established through the Clean Water Act); the NPDES Nonpoint Source Program objective is to control and reduce pollutants to water bodies from nonpoint discharges. The Program is administered by the California Regional Water Quality Control Boards. Dairy projects implemented under the Element would be required to comply with the general nonpoint source permits covering both construction activities and operation-period industrial activities.

General Construction Permit

Projects disturbing more than five acres of land during construction are required to file a Notice of Intent (NOI) with the RWQCB to be covered under the State NPDES General Construction Permit for discharges of storm water associated with construction activity. A developer must propose control measures that are consistent with the State General Permit. A Storm Water Pollution Prevention Plan (SWPPP) must be developed and implemented for each site covered by the general permit. A SWPPP should include Best Management Practices (BMPs) designed to reduce potential impacts to surface water quality through the construction and life of the project.

General Industrial Permit

The control of nonpoint source runoff from industrial sources and associated pollutants is regulated in California by the State Water Resources Control Board under the statewide General Permit for Stormwater Discharges Associated with Industrial Activities Order No. 97-03-DWQ. The General Permit presents the requirements for compliance of certain industries with the NPDES. A wide range of industries is covered under the general permit, including mining operations, lumber and wood products facilities, petroleum refining, metal industries, and some agricultural product facilities such as dairies.

In an effort to address the need to permit numerous dairies throughout the Central Valley, the RWQCB adopted General Waste Discharge Requirements for Milk Cow Dairies (Order No. 96-270), which established the specifications for dairy manure management and an application process for dairy operations intending to comply with the requirements of the Clean Water Act. These waste discharge requirements represent more specific requirements for the dairy industry than the requirements of the General Industrial Permit.

In practice, very few dairies in the Central Valley region are currently operating under Order No. 96-270 (Wass, 1999), which presents facility design and operation requirements that address potential sources of pollution from both storm water runoff and application of manure and dairy process water to land. The General Industrial Permit described above covers only the potential sources of pollution from runoff. In the past, dairy operators have typically requested, and received, waivers of the RWQCB waste discharge requirements described under Order No. 96-270, and opted to comply with the NPDES requirements under the General Industrial Permit.

Groundwater Quality

The groundwater basin in the Kings County portion of the San Joaquin Valley is an internally drained and closed basin. It has no appreciable surface or subsurface outflow, except in extremely wet years. Salts (generally measured as total dissolved solids [TDS]) are introduced into the basin with imported water supplies. Although the water may leave the basin by evaporation or evapotranspiration, the majority of the salts stay behind, potentially leading to a build-up of salt in the soil and groundwater. Excessive salt loading can result in a degraded water supply, particularly if concentrations exceed the Secondary Drinking Water standard of 500 mg/L. Salt loading of managed groundwater basins is an important issue throughout the San Joaquin Valley. In addition, many of the naturally-occurring deposits in the vicinity of the project site are of marine origin and, therefore, have high salt content.

The distribution of TDS and trace elements in the Tulare Lake Basin was assessed by the U.S. Geological Survey (USGS) to evaluate potential problems associated with disposal of irrigation drain water containing elevated levels of selenium and other trace elements

(Beard, et al., 1994; Fujii, et al., 1995). In 1983, deformities of embryos and young waterfowl associated with elevated selenium concentrations were discovered at Kesterson Reservoir (Tulare Lake Drainage District, 1988). The concern was that the disposal of irrigation drain water into evaporation ponds of the Tulare Lake Basin (the same practice employed at Kesterson) could concentrate the trace elements to levels that could be harmful to wildlife.

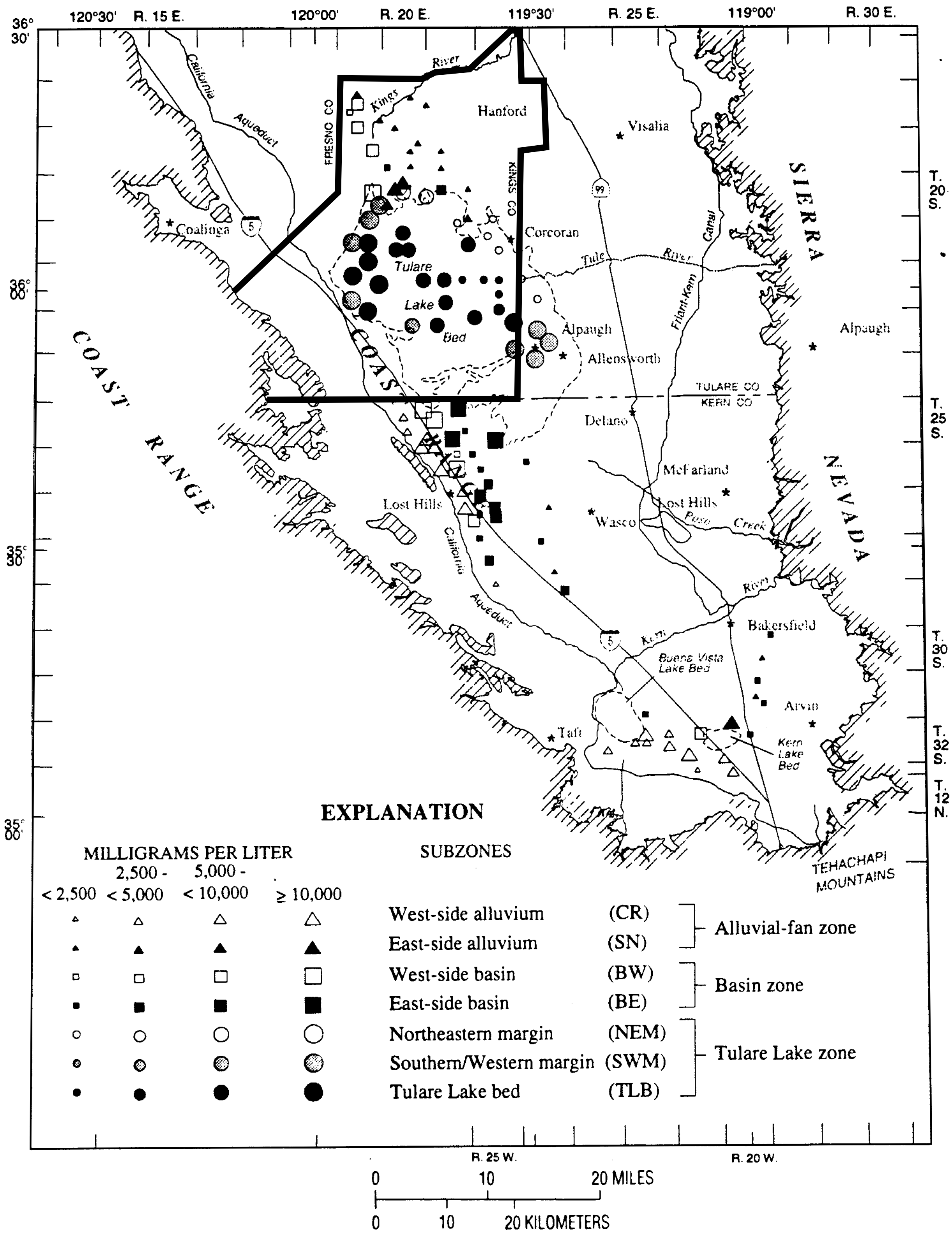
The results of the USGS study regarding TDS are summarized on Figure 4.3-4, which indicates that much of the shallow groundwater in the Tulare Lake Bed and alluvium/basin areas contains elevated levels of TDS, far in excess of the EPA's secondary drinking water standard of 500 mg/L. In general, water quality improves with depth. The deeper confined aquifer below the E-clay has been reported to contain water with TDS levels ranging from 179 to 569 mg/L (Kings County Planning Agency, 1999).

Additional analysis of shallow groundwater quality was conducted during the evaluation of environmental effects of the evaporation ponds northeast of Corcoran operated by the Tulare Lake Drainage District (TLDD). Water quality data collected from the tile drains and shallow monitoring wells in the vicinity of the TLDD evaporation ponds indicate that the perched (uppermost) groundwater in the central portion of the Tulare Lake Bed exceeds drinking water quality standards for total dissolved solids (and electrical conductivity), sulfate, chloride, and other constituents. The findings presented in the RWQCB 1993 Waste Discharge Requirements (WDR) for the TLDD evaporation ponds included a determination (#32) that the perched groundwater in the vicinity (within one mile) of the ponds "cannot be used for municipal or domestic supply without extensive treatment" and "is therefore not expected to supply a public water system." Finding #31 suggests that groundwater within the Tulare Lake Basin with total dissolved solids (TDS) concentration in excess of 3,000 mg/L is not suitable as a drinking water supply.

As described above, the hydrogeology of the Kings County area has played an important role in the development of the conditions that resulted in the presence of high salinity near-surface groundwater. The contribution of human activities (i.e., agriculture, groundwater pumping, water transfers) on the salt balance is less clear. A United States Geological Survey (USGS) study of the Sacramento Valley of California was conducted to determine whether human activities had affected groundwater quality through time (Bertoldi, et al., 1991). Significant increases in TDS and nitrates have been observed since the 1950s, indicating that groundwater quality was degraded as a result of increasing application of agricultural chemicals and growth of urban populations. No similar studies for the San Joaquin Valley were reported, but "because agricultural practices in the San Joaquin Valley are similar to those of the Sacramento Valley, it is likely that groundwater quality in the San Joaquin Valley is also degrading as a result of human activity."(Bertoldi, et al., 1991).

DISTRIBUTION OF SALINITY, TULARE BASIN, CALIFORNIA

Figure 4.3-4



Source: Fujii, et al., 1995.

The results of a subsequent study conducted by the USGS on nitrate and pesticide trends in groundwater in the eastern San Joaquin Valley (Dubrovsky, et al., 1998) indicate that groundwater drinking water supplies have been degraded by fertilizers and pesticides. Of approximately 100 various types of wells monitored, nitrate concentrations exceeded U.S. EPA drinking water standards about one-fourth of the time and pesticides were identified about two-thirds of the time (although mostly at low concentrations).

As stated in the Basin Plan (1995 - page IV-1):

> *The greatest long-term problem facing the entire Tulare Lake Basin is the increase of salinity in groundwater. Even though an increase in the salinity of groundwater in a closed basin is a natural phenomenon, salinity increases in the Basin have been accelerated by man's activity, with the major impact coming from intensive use of soil and water resources by irrigated agriculture. Salinity increases in groundwater could ultimately eliminate the beneficial uses of this resource. Controlled groundwater degradation by salinity is the most feasible and practical short-term management alternative for the Tulare Lake Basin.*

RELEVANT GOALS, OBJECTIVES, AND POLICIES

The Kings County Draft Dairy Element (Appendix A) includes goals, objectives, and policies that address hydrology and water quality issues. Specifically, **Goal DE 1** proposes to restrict dairies to locations where they are most compatible with surrounding land uses and environmental constraints (including flood hazard areas and areas of high groundwater); **Objective DE 1.2** commits the County to using specific ~~criteria~~ standards to avoid associated land use conflicts. **Policy DE 1.2c** states that dairy facilities, including manure and dairy process water storage areas, shall not be located in Special Flood Hazard Areas (as designated by FEMA). However, dairy manure and process water could be transported into the flood hazard areas and applied to land if appropriate safeguards are implemented. **Policy DE 1.2d** would not allow dairy facilities or manured areas (including corrals and process water ponds) to be located in areas of high groundwater (defined as groundwater within five feet of the surface) without specific approved mitigation measures designed to protect groundwater quality. In addition, **Policy DE 1.2f** would not allow new or expanded dairies in the hilly uplands of the southwest portion of the County where it would be considered difficult to contain dairy manure and process water (and therefore protection of surface water quality would be more difficult).

Goal DE 3 proposes to develop a countywide policy for the evaluation and distribution of dairies and (**Objective DE 3.1**) to consider potential environmental effects of dairies when reviewing proposals for new or expanded facilities. One of the specific siting criteria (included as part of **Policy DE 3.1a**) is consideration of groundwater and surface water quality and quantity. **Objective DE 3.2** proposes that the suitability of a site be evaluated based on its ability to adequately manage generated waste. **Policy DE 3.2a** provides specific hydrologic conditions that should be evaluated when siting dairy facilities. **Policy DE 3.2c** proposes a 150-foot setback of manured areas (at the dairy facilities) from surface water features and flood plains. **Policy DE 3.2d** would prohibit discharge of dairy process water to surface water features. **Policy DE 3.2f** would require implementation of monitoring programs to ensure that each dairy attains the desired results and significant adverse impacts are avoided.

Goal DE 4 proposes the use of comprehensive ~~system~~ manure nutrient management techniques in the operation of dairies. **Objective DE 4.1** would require that a ~~Comprehensive~~ Manure Nutrient Management Plan be submitted with each new or expanded dairy application. **Policy DE 4.1a** includes several specific provisions for proper handling and storage of manure to prevent water pollution. The provisions of this policy require dairies to demonstrate that clean water is diverted away from manured areas. In addition, the policy sets specific standards for minimizing infiltration of dairy process water from storage ponds. These provisions are discussed in Impact 4.3-7. **Policy DE 4.1b** would establish requirements for manure management, including maintenance of nutrient balance between land application and crop. Under **Policy DE 4.1c**, operators would be required to implement appropriate land management techniques to ensure that runoff of soil, nutrients, organic matter, and pathogens would be minimized. In addition, **Policy DE 4.1d** would mandate appropriate management of dead animals to protect surface and groundwater quality. Under **Objective DE 4.2,** dairy operators would have to prepare and submit a Comprehensive Dairy Process Water Application Plan with each new or expanded dairy application. **Policy DE 4.2a.B** would require an enforceable and recordable agreement specifying the terms of off-site use of the dairy's process water and manure. **Policy DE 4.2a.A** requires dairy operators to identify land available for reuse of process water and manure and estimate the amount of water and manure generated by the dairy (and the salt and nitrogen content). Additionally, the policy requires the operator to provide substitute acreage for any identified lands that are sold or to reduce the dairy herd in response to loss of available land.

Goal DE 6 would implement a monitoring program to demonstrate the effectiveness of the provisions of the Element and associated mitigation measures, and would allow for adjustments in dairy operations, if deemed necessary, to protect the environment (**Objective DE ~~6.1~~ 6.2**). **~~Policies~~ Policy DE ~~6.1a~~ 6.2a** through **~~6.1c~~ 6.2b** would establish baseline environmental conditions, monitor the bovine carrying capacity of the county, and develop a database of dairy characteristics. **Objective DE ~~6.2~~ 6.3** would implement a monitoring program for each dairy. Under **Policy DE ~~6.2a~~ 6.3a**, each dairy would have to implement annual testing to demonstrate that the facility is operating under approved conditions and, if conditions are violated, would be subject to modification of the operation. **Policy DE ~~6.1h~~ 6.2f** establishes that a groundwater quality monitoring program be required of all approved dairies.