2.0 DESCRIPTION OF STUDY AREA

2.0 DESCRIPTION OF STUDY AREA

2.1 PHYSIOGRAPHY

The central portion of the study area, the Imperial Valley, lies within the Salton Trough, a large structural and topographic depression, representing a sediment-filled fault block bounded generally by the San Jacinto fault system on the west and the San Andreas fault system on the east. The trough, which is about 130 miles long and as much as 70 miles wide, is a landward extension of the depression filled by the Gulf of California, from which it is separated by the broad fan-shaped subaerial delta of the Colorado River (Loeltz *et al.* 1975). The Salton Trough is the dominant feature of the Colorado Desert geomorphic province of California. The term Salton Trough refers to the entire basin, whereas the term Salton Basin applies to only the region draining directly into the Salton Sea (Norris and Webb 1976).

2.1.1 Land Surface Topography

The Salton Basin is bounded to the west by the Vallecito and Jacumba Mountains, to the north-northeast by the Orocopia and Chocolate Mountains, to the southeast by the Sand Hills and Cargo Muchacho Mountains, and to the south by the Mexican-American international border. The major topographic features of the basin are shown on Figure 2-1. The highest point along the basin watershed boundary is Blue Angel Peak in the Jacumba Mountains at 4,284 feet above sea level. The lowest visible feature in the basin is the surface of the Salton Sea. The historic recorded low elevation of the modern Salton Sea was 252.2 feet below sea level on December 19, 1919 (Imperial Irrigation District, personal communication, 1999). The current elevation of the sea (1999) is approximately 226 feet below sea level.

Elevations along the Imperial Valley floor range from approximately sea level near Calexico to approximately 230 feet below sea level at the south shore of the Salton Sea to the north-northeast, a slope of approximately 7 feet per mile. The Mexicali Valley is a southern extension of the same general topographic feature into Mexico. The northern Mexicali Valley is part of the Salton Basin and drains north across the U.S. border. The southern Mexicali Valley drains to the Gulf of California.

2.1.2 Climate

The Salton Basin has a typical desert climate, characterized by hot, dry summers and mild winters. Summer temperatures typically exceed 100°F in the summer months, with winter low temperatures rarely dropping below 32°F. Rainfall in the basin averages approximately 3 inches per year, with the majority of the rainfall occurring from November through March. Periodic summer thunderstorms are common in the region. Total recharge to the groundwater system from precipitation within the valley is estimated to be somewhat less than 10,000 acre-feet per year (Loeltz *et al.* 1975). Evaporation averages over 98 inches per year in Imperial Valley, while plant evapotranspiration is as high as 60 to 72 inches per year.

The relatively flat topography of the Imperial Valley and surrounding areas in conjunction with strong night and day temperature differentials, particularly in the summer months, produce moderate winds and deep thermal circulation systems. The thermal systems facilitate general dispersion of local air pollution, in contrast to coastal basins where polluted inversion layers may remain for long periods of time (County of Imperial General Plan 1997).

2.1.3 Geology

The Salton Trough is a structural as well as a topographic depression in which the surface of the basement complex lies thousands to tens of thousands of feet below the basement complex surface in the bordering mountains (Loeltz *et al.* 1975). The trough has been filled with marine and non-marine deposits that overlie a pre-Tertiary basement complex. During the Holocene, and probably during the Pleistocene epochs, the Colorado River periodically breached the prograding Colorado River delta, discharging into the Salton Trough rather than to the Gulf of California, resulting in the formation of a large ephemeral lake in the closed basin (Michel and Schroeder 1994).

The Salton Basin is structurally controlled by the San Andreas fault zone to the northeast, and the San Jacinto fault zone to the southwest. Each system is made up of major and minor subparallel lineaments running from the northwest to the southeast. The San Andreas fault zone runs from the upper Coachella Valley to the southeastern corner of Imperial County, beyond which the San Andreas has no obvious surface expressions. Since the Pliocene, the Salton Basin portion of the San Andreas appears to have been offset

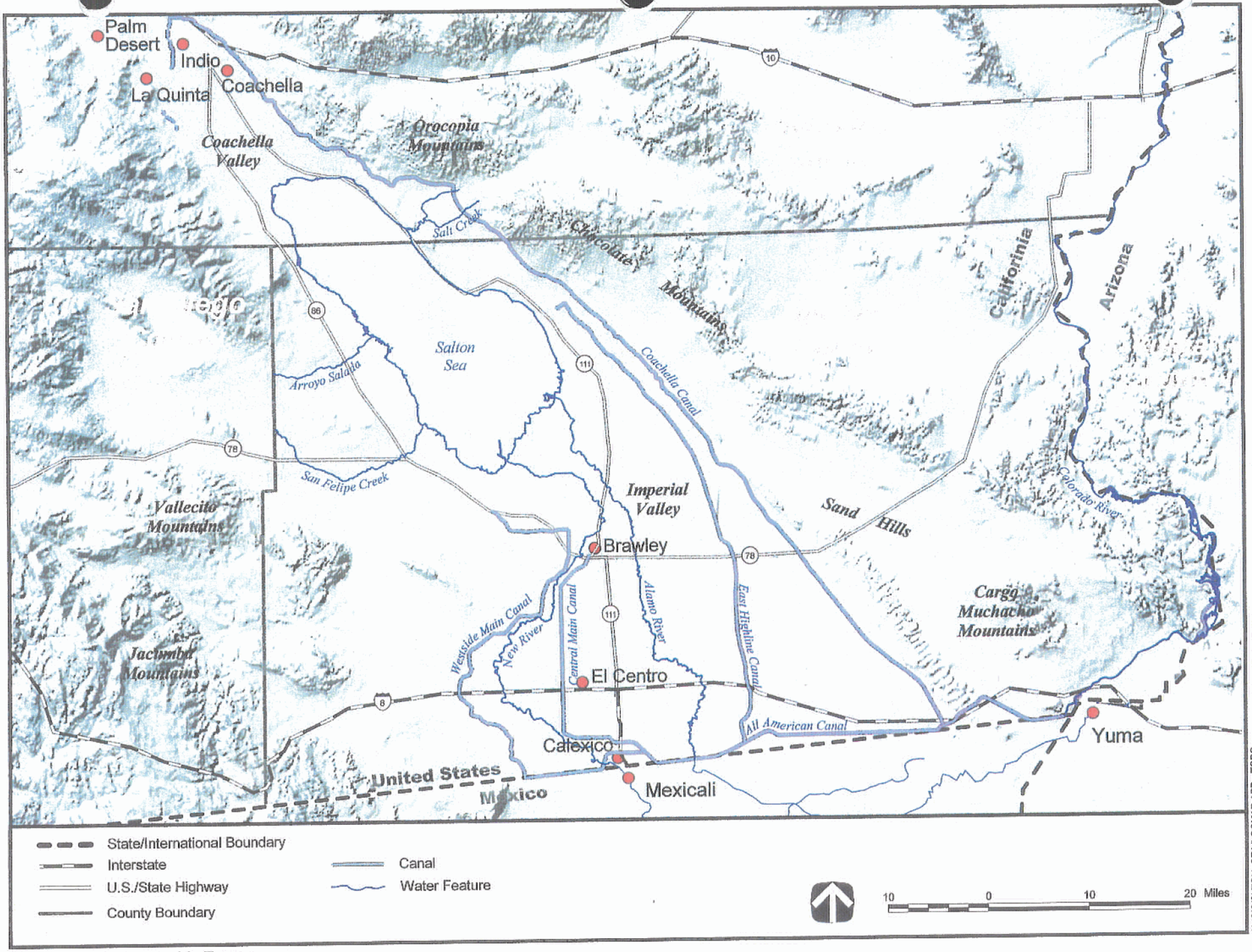

Figure 2-1 Topographic Features

several miles right laterally, and post-Eocene offset may total 180 miles (Norris and Webb 1976). The major geologic features of the study area are shown on Figures 2-2a and 2-2b.

The oldest rocks on the periphery of the Salton Basin are Precambrian crystalline gneisses, anorthosites, and schists which occur in the Chocolate, Cargo Muchacho, Orocopia mountains and at Pilot Knob, an isolated hill near the international border. These ancient rocks have been intruded by several younger plutonic bodies, ranging from late Paleozoic to middle Cenozoic (Norris and Webb 1976).

The Imperial Valley has accumulated up to 20,000 feet of marine and non-marine Cenozoic deposits with the thickest deposits occurring in the center of the basin south of Brawley. Soil types in the Imperial Valley are predominantly silty clays and clay that have been deposited as near-horizontal deposits on lake beds and sheet-flow deposits during seasonal floods. Based on classifications by the Natural Resource Conservation Service (formerly known as the Soil Conservation Service), regional soil classifications by series for the study area are shown on Figure 2-3. The lowest part of the study area consists of generally moderately well-drained and well-drained silty and loamy fine sand soils that developed on the lake bed deposits of prehistoric Lake Cahuilla. A portion of the study area occupied by the Carsitas-Myoma-Currizo association has been classified as somewhat excessively drained (Figure 2-3). The soils in the southeast section of the study area are generally excessively or well-drained sands, while soils on the southwest portion tend to be well-drained silty and loamy fine sands.

In the East Mesa area, east of the East Highline Canal, well drained sandy to silty clay soils predominate (Montgomery Watson 1995). In the southeastern study area, the former shoreline of prehistoric Lake Cahuilla roughly coincides with the East Highline Canal. The East Mesa area was formed primarily by fluvial processes, but was locally modified by lacustrine, or possibly marine, processes. The mesa surface is mantled extensively by irregular sheets of windblown sand that are generally less than 20 feet thick (Loeltz *et al.* 1975).

2.1.4 Surface Water Hydrology

2.1.4.1 Natural Streams, Rivers, and Lakes

The Colorado River, through diversions, is the primary source of water for Imperial County and more specifically, to the study area. Ten major reservoirs along the Colorado River system provide over

50 million acre-feet of storage capacity, approximately four times the total average annual natural flow of the Colorado River (Montgomery Watson 1995). Diversions to the Imperial Basin are through the All American Canal (AAC) and Coachella Branch (CB), which are discussed in Section 2.1.4.2. The Imperial Basin is a closed drainage system, with all surface flow not percolating into subsurface storage or evaporating eventually draining into the Salton Sea. The major drainage features in the study area are the New River, the Alamo River, Salt Creek, San Felipe Creek, and Tule Wash. Major hydrologic features for the study area are shown on Figure 2-4.

The Imperial Valley is drained by the south-to-north flowing New and Alamo Rivers. These two rivers account for approximately 75 percent of the total runoff in the valley, supplying nearly all of the recharge to the Salton Sea (Michel and Schroeder 1994). Both of the Rivers cross extensively irrigated farmland, intercepting post irrigation seepage collected along an elaborate subdrain tile system. The channels of the two rivers were considerably widened and deepened between 1904 and 1907, when the bulk of Colorado River water was entering Imperial Valley through man-made openings in the levee south of the international border. The watershed drainage routing for the study area is shown on Figure 2-5. Flows in these rivers at both the United States border and Salton Sea are given in Table 2-1.

Salt Creek is the major drainage feature along the unlined portion of the CB of the AAC. The creek drains the southern slopes of the Orocopia Mountains and the northwest end of the Chocolate Mountains. The most important western drainage in the basin is San Felipe Creek, with headwaters in the Peninsular Ranges near Julian approximately 50 miles west of the Salton Sea. Flow in the lower reaches of San Felipe Creek is perennial, fed by several hot springs that support a thriving population of desert pupfish.

2.1.4.2 Canals and Drains

The AAC and CB transport Colorado River water diversions to the Imperial Valley and the lower part of the Coachella Valley, respectively. In 1940, the AAC became the single source for Colorado River water in the Imperial Valley. The CB was completed in 1948. The locations of the canals are shown on Figure 2-4.

At Drop No. 1 on the AAC, approximately 15 miles west of Pilot Knob, flow is partially diverted to the northwest running CB. The CB is approximately 123 miles long. The first 49 miles of the CB was concrete lined in the late 1970s. The next 37 miles of the canal is unlined with the exception of a section that was lined as part of a pilot study between Siphons 14 and 15. The remaining 37 miles of the canal leading to