SECTION 3.6: SOILS AND GEOLOGY

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on the soils and geology within the DMC Unit. Information in this section was summarized from the Draft CVPIA PEIS, Soils and Geology, Technical Appendix, Volume 2 (Reclamation 1997b).

AFFECTED ENVIRONMENT

This section describes the soils and geologic conditions found within the project area, which is located in the San Joaquin Valley and includes portions of San Joaquin, Stanislaus, Merced, and Fresno Counties as well as the geographic service areas of the 20 DMC Unit contractors.

SOILS

The soils of the San Joaquin Valley are divided into four physiographic groups: valley land soils, valley basin soils, terrace soils, and upland soils. Valley land and valley basin land soils comprise most of the San Joaquin Valley floor. In the vicinity of the Delta-Mendota Canal, valley land soils consist of deep alluvial and aeolian soils that make up some of the best agricultural land in California. Valley basin lands consist of organic soils of the delta, poorly drained soils, and saline and alkali soils in the valley trough and on the basin rims.

The San Joaquin Valley experiences drainage and soil salinity problems. Drainage problems are a result of irrigated agriculture in an area with shallow groundwater tables and little or no drainage outlet. In a large part of the valley, on the west side, shallow groundwater tables, salts imported by water deliveries, and accumulation of natural salts in soil and groundwater from irrigation threaten sustained agriculture.

Backlund and Hoppes (1984) estimated that about 2.4 million of the 7.5 million acres of irrigated cropland in the Central Valley have been affected by salt. These saline soils generally exist in the valley trough and along the eastern and western edges on both sides of the San Joaquin Valley. By the year 2000, it was projected that up to 918,000 acres of farmland in the San Joaquin Valley would be affected by high water tables less than five feet from the ground surface (San Joaquin Valley Drainage Program 1990). In addition to drainage, problems have occurred with the accumulation of toxic metals (arsenic, boron, molybdenum, and selenium) that have leached from natural deposits through the application of irrigation water.

Selenium in the soil is primarily a concern on the west side of the San Joaquin Valley. When the soils in this area are irrigated, selenium, other salts, and trace elements dissolve and leach into the groundwater (Gilliom et al. 1989). Over the past 30 to 40 years of irrigation, most soluble selenium has been leached from the soils into the shallow groundwater. It is drained from those soils when growers try to protect crop roots from salts and the high water table.

In areas with high selenium concentrations, selenium leached from the soils enters irrigation return flows and subsurface drainage flows. Irrigation of these soils further mobilizes selenium, facilitating its movement into shallow groundwater that is retained in poorly drained or mechanically drained soils. In the absence of adequate drainage facilities, leaching cannot fully remove the salts from these soils because water cannot percolate beyond one or more confining clay layers under the shallow groundwater aquifer.

GEOLOGY

The San Joaquin Valley is part of a large, northwest-to-southeast-trending asymmetric trough of the Central Valley, which has been filled with up to six vertical miles of sediment. This sediment includes both marine and continental deposits ranging in age from Jurassic to Holocene. The San Joaquin Valley lies between the Coast Ranges on the west, the Sierra Nevada on the east, and extends northwestward from the San Emigdo and Tehachapi Mountains to the Delta near the City of Stockton. The San Joaquin Valley is 250 miles long and 50 to 60 miles wide. The relatively flat alluvial floor is interrupted occasionally by low hills.

The San Joaquin Valley floor is divided into several geomorphic land types including dissected uplands, low alluvial fans and plains, river floodplains and channels, and overflow lands and lake bottoms. The alluvial plains cover most of the valley floor and comprise some of the most intensely developed agricultural lands in the San Joaquin Valley. In general, alluvial sediments of the western and southern parts of the San Joaquin Valley tend to have lower permeability than eastside deposits.

Near the valley trough, fluvial deposits of the east and west sides grade into fine-grained deposits. The San Joaquin Valley has several thick lakebed deposits. The deposit that most notably affects groundwater and confinement is the Corcoran Clay Member, deposited about 600,000 years ago. This clay bed, which is found in the western and southern portions of the valley, separates the upper semi-confined to unconfined aquifer from the lower confined aquifer (Page 1986). The clay bed covers approximately 5,000 square miles and is up to 160 feet thick beneath the present bed of Tulare Lake.

Subsidence occurs in the western San Joaquin Valley as a result of reduced groundwater elevations and the related compaction of the soil interstitial spaces that had previously been filled with groundwater. Land subsidence has caused substantial reductions in ground elevations in some locations.

ENVIRONMENTAL CONSEQUENCES

Implementation of the project alternatives would result in adverse geologic impacts if it increased the likelihood of or resulted in exposure to earthquake damage, slope failure, foundation instability, land subsidence, or other severe geologic hazards. It would be considered an adverse impact if it caused severe erosion or sedimentation or resulted in the loss of the use of soil for agriculture or habitat, loss of aesthetic value associated with a unique landform, or loss of mineral resources.

NO-ACTION ALTERNATIVE

Groundwater levels may decline 1 to 3 percent because of the allocation of CVP water to Level 2 refuge water supplies and improved fish and wildlife habitat. As a result of increased groundwater pumping, land subsidence could increase over its present rate.

Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that CVP deliveries are curtailed in some years, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping could increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, local groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. Soils may increase in salinity because salts may concentrate from an insufficient surface water supply for adequate leaching or because of poor quality, pumped groundwater.

ALTERNATIVE 1

Alternative 1 could have impacts similar to those discussed above for the No-Action Alternative. Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that CVP deliveries are curtailed in some years, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. Soils may increase in salinity as salts concentrate as a result of an insufficient surface water supply for adequate leaching or poor quality, pumped groundwater.

ALTERNATIVE 2

Alternative 2 could have impacts similar to those discussed above for the No-Action Alternative. Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that deliveries of CVP surface water are reduced, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. Soils may increase in salinity as salts concentrate as a result of an insufficient surface water supply for adequate leaching or poor quality, pumped groundwater.

CUMULATIVE IMPACTS

Long-term contract renewals, when considered in combination with other past, present, and reasonably foreseeable future actions, will not likely result in cumulative impacts to soils and geologic resources. Some DMC Unit soils may be subject to growth and development pressures that indirectly lead to the conversion of their current uses to commercial, residential, or industrial use. However, these decisions are made at the individual and local levels, and are difficult to estimate because of the speculative nature of the real estate market and locations where such pressures may arise, the ability of local jurisdictions to enforce best management practices encouraging wind and water erosion control, and the localized effectiveness of such practices. Long-term contract renewals continue the delivery of water to predominantly irrigated lands in the DMC Unit. Deliveries support the continued beneficial impacts of current farming practices that encourage erosion control from an economic standpoint. Erosion control measures practiced by DMC Unit farmers conserve topsoil that is rich in nutrients and water-holding capacity—qualities that are expensive to replace—thereby maintaining the agricultural quality of potentially affected soil resources.