Attachment 2 Geology and Hydrogeology – East Subbasin and Piru Subbasin

2.1. East Subbasin

The East Subbasin consists of an alluvial trough bounded by granite and granodiorite of the San Gabriel Mountains (to the south) and the mountains of the Angeles National Forest (to the north). The East Subbasin consists of water bearing sediments and non-water bearing sediments.

In general, alluvium in the main river valley ranges from medium-grained sand to sandy gravel and cobbles. Alluvium along the main Santa Clara River (SCR) channel ranges from cobbley or gravelly sand in the east, to medium-grained sand in the west. Drillers' logs indicate the presence of discrete sand zones and discrete gravel zones in many areas of the alluvium. Because of its unconsolidated to poorly consolidated condition, lack of cementation, and texture, the alluvium is highly permeable.

The recent alluvial sediments lie within and along the course of the SCR and its main tributaries. The maximum thickness of the alluvium varies along the SCR, but is generally up to 200 feet thick with the greatest thicknesses occurring near the central portion of the river, and thinning or pinching out near the flanks of the adjoining hills. Groundwater elevation data and aquifer test data from alluvial wells indicate that the Alluvial Aquifer is unconfined (i.e., is under water table conditions).

Below the shallow alluvium, the Saugus Formation is also water bearing. The Saugus Formation contains lenticular and interfingered beds of poorly to well-consolidated sandstone, conglomerate, and siltstone that are at least 7,500 feet thick in the deepest part of the basin.

Available aquifer test data from Saugus wells located near the center of the valley where the Saugus is thickest indicate that the Saugus is semiconfined to confined (under pressure). In areas where the Saugus crops out, the uppermost saturated zones are partially unconfined because the permeable beds are folded upwards. In the highlands, the Saugus beds are exposed at the ground surface, and in the valley, the Saugus beds are in contact with the Alluvial Aquifer.

Underlying the water-bearing sediments in the SCV are a series of consolidated, older, cemented sedimentary and crystalline rocks of Tertiary geologic age or older. For the most part, the sedimentary rocks are exposed along the flanks of the hills and mountains that border the SCV, and the geologically older crystalline metamorphic and igneous rocks crop out in the upper watershed areas of the Sierra Pelona and San Gabriel Mountains.

Geologically older sedimentary rocks underlie the base of the Saugus Formation and are exposed in the hills beyond the exterior boundary line for the mapped surface limits of

the Saugus Formation. The older rocks lying immediately below the Saugus Formation are (1) the Pico Formation, composed of gray marine sandstone, siltstone, and shale, which underlies the Saugus Formation in the region southwest of the San Gabriel Fault; and (2) the Castaic Formation and the Mint Canyon Formation, mainly siltstone and shale, which underlie the Saugus Formation in areas northeast of the San Gabriel Fault. These sedimentary rock formations are generally fine grained, have low permeability, and do not yield substantial quantities of water to wells.

2.2. Piru and Eastern Fillmore Subbasins

The Piru and Eastern Fillmore Subbasins consist of an alluvial trough bounded by the Topatopa Mountains and the San Cayetano Fault to the north and the Oak Ridge and Santa Susanna Mountains and the Oak Ridge Fault to the south. Lithologic units include (from upper units to lower units) the following: recent alluvium, older alluvium, terrace deposits, San Pedro Formation, and the Pico Formation. These units are underlain by Precambrian basement rock.

Water-bearing Sediments

- Alluvium

Recent alluvial deposits are found across the extent of the Piru and Eastern Fillmore Subbasins. These deposits consist of interbedded sands, gravels, silts, and clays deposited by the SCR, Piru Creek, Hopper Creek, and smaller tributaries. Deposits found along the SCR consist primarily of coarse sand and gravel. Lower permeability materials are found with distance from the stream channels. These finer grained deposits represent inter-stream and inter-fan areas and create local zones of perched groundwater. Near the eastern margin of the Piru Subbasin (at Blue Cut), recent alluvium is believed to be thin; perhaps only tens of feet thick. Over most of the basin, thickness ranges from 60 to 80 feet.

Alluvial deposits were subdivided into several aquifer systems by the USGS including the following:

- Shallow Aquifer – Recent alluvium consisting of sand and gravel deposits of the SCR that extends to depths of 60 to 80 feet below ground surface (ft bgs)
- Oxnard Aquifer – Recent alluvium consisting of basal sand and gravel deposits that extends to depths of 150 to 200 ft bgs
- Mugu Aquifer – Older alluvium composed of the basal portion of the upper Pleistocene deposits that extends to depths of 200 to 400 ft bgs

The USGS groups these various alluvial deposits into the Upper Aquifer System. Sediments within the Upper Aquifer System lack cementation and are coarse grained, resulting in highly permeable material.

- San Pedro Formation

The Pliocene to Pleistocene age San Pedro Formation underlies the Upper Aquifer System and consists predominantly of lenticular deposits of sands and gravels with local lenses of clay. Deposits of the San Pedro Formation are terrestrial and analogous to the Upper Saugus Formation in the East Subbasin. Although sediments of the San Pedro Formation underlie the entire basin, they are not exposed at land surface within the extent of the Piru or Eastern Fillmore Subbasins. The San Pedro Formation has a reported thickness of more than 5,000 feet in the Piru Subbasin. Geophysical logging of one oil well in the Piru Basin indicated that the San Pedro Formation extends to depths of up to 8,800 ft bgs. It is suggested that this thickness is the result of either repetition of beds from faulting or steeply dipping beds.

Deposits of the San Pedro Formation have been referred to as either the Hueneme Aquifer (upper and lower) or Lower Aquifer System. The Upper Hueneme Aquifer is up to 200 feet thick and is composed of terrestrial lenticular beds of coarse-grained light gray and brown sandstone and conglomerate. The Lower Hueneme Aquifer is up to well over 2,000 feet thick and is composed of interfingered gray to greenish-gray fine-grained sandstone and siltstone (brackish water). Much of the Lower Hueneme Aquifer yields little water and is not considered viable for groundwater development.

Non-water-bearing Bedrock

Underlying the water-bearing sediments in the Piru and Eastern Fillmore Subbasins are a series of consolidated, older, cemented, sedimentary, and crystalline rocks of upper Cretaceous and Tertiary age. These rocks are considered non-water bearing because of their fine-grained texture and low permeability. These units form the base of the groundwater system within the subbasins. Generally the older rocks outcrop in the Topatopa Mountains to the north of the subbasins and in the Santa Susanna Mountains to the south. Erosion of these rocks provided the source of unconsolidated sediments within the groundwater basins.

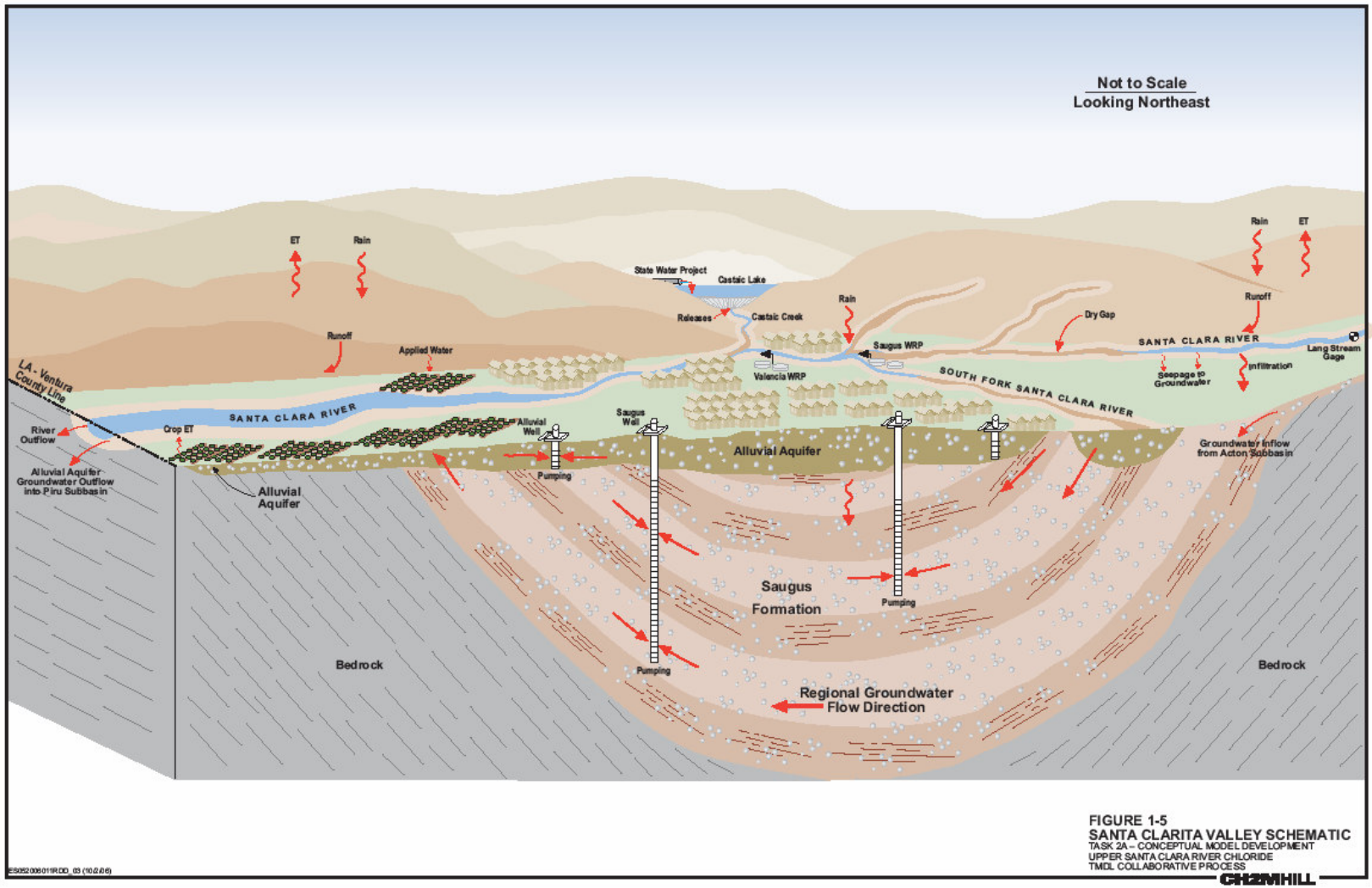

FIGURE 1-5
SANTA CLARITA VALLEY SCHEMATIC
TASK 2A – CONCEPTUAL MODEL DEVELOPMENT
UPPER SANTA CLARA RIVER CHLORIDE
TMDL COLLABORATIVE PROCESS

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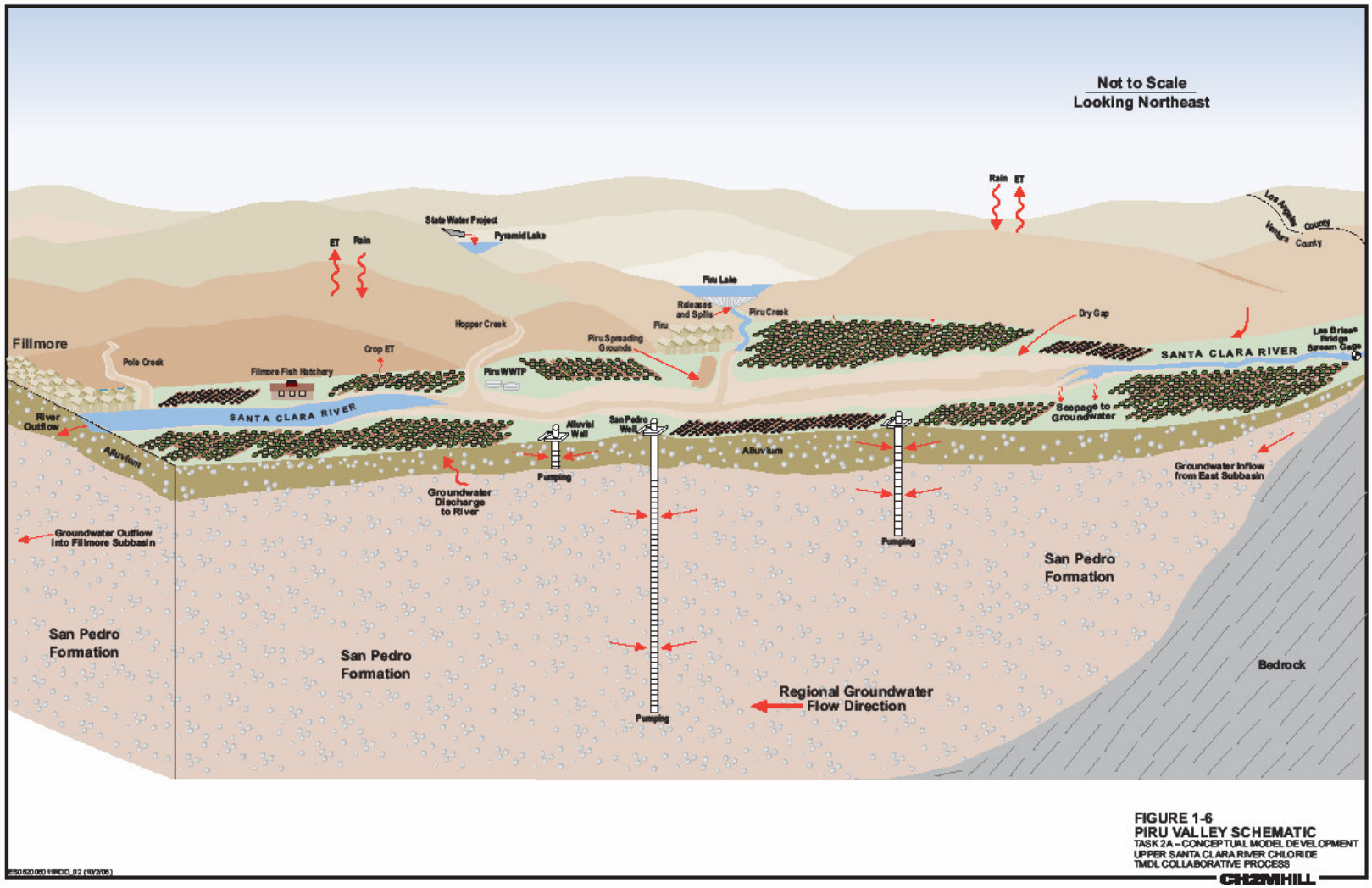
Not to Scale
Looking Northeast
Rain
ET
State Water Project
Pyramid Lake
ET
Rain
Piru Lake
Releases and Spills
Piru Creek
Piru
Dry Gap
Los Angeles County
Ventura County
Hopper Creek
Piru Spreading Grounds
Fillmore
Pole Creek
Crop ET
Fillmore Fish Hatchery
Piru WWTP
SANTA CLARA RIVER
Las Brisas Bridge Stream Gage
River Outflow
Alluvium
SANTA CLARA RIVER
Alluvial Well
San Pedro Well
Alluvium
Seepage to Groundwater
Groundwater Inflow from East Subbasin
Groundwater Discharge to River
Pumping
Pumping
Groundwater Outflow into Fillmore Subbasin
San Pedro Formation
San Pedro Formation
San Pedro Formation
Bedrock
Regional Groundwater Flow Direction
Pumping
FIGURE 1-6
PIRU VALLEY SCHEMATIC
TASK 2A – CONCEPTUAL MODEL DEVELOPMENT
UPPER SANTA CLARA RIVER CHLORIDE
TMDL COLLABORATIVE PROCESS
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