

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

In re: Draft Order WR 2009-0079-DWR)
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)
RUDY MUSSI, et al.,)
_____)) APN 131-170-03

INTRODUCTION/QUALIFICATIONS

I am Christopher H. Neudeck, P. O. Box 844, Stockton, California 95201. I am a registered Civil Engineer in the State of California and have worked with the Delta Islands including flood control, drainage and irrigation for the past twenty-five (25) years. I am the District Engineer for numerous reclamation districts in the Sacramento/San Joaquin Delta (Delta) and I am familiar with the history of reclamation of lands in the Delta including the Upper Division of Roberts Island which is the area of concern in this proceeding. The engineering firm of Kjeldsen, Sinnock & Neudeck, Inc. of which I am a principal is the engineer for Reclamation District No. 544 which encompasses the area of concern and adjoining districts Reclamation District No. 17 and Union Island Reclamation Districts 1 and 2. I am very familiar with the area including the waterways, levees, drains and irrigation facilities. A statement of my qualifications is submitted as a separate exhibit.

My testimony involves two main areas. The first is the review and mapping of title and other documents. The second is a summary of the irrigation and drainage practices of the southern Delta, and how these practices evolved over time.

With regard to the first, I begin with the Chain of Title produced for the Mussi property by Central Valley Land Service Company. I understand the research and production of documents was done by Mr. Thurl Pankey, one of the principles of Central Valley Land Service Company and any of his associates.

The Mussi property is San Joaquin County Assessor's Parcel No. 131-170-03. The tax assessor parcel map showing this parcel is Exhibit 3A to this testimony. Hereinafter, I will refer to this property as either the "Parcel" or the "Mussi Parcel."

When mapping this Parcel, I have ignored any deeds or indentures which date prior to the Parcel being patented from the State of California per instructions by counsel. By way of patent dated November 24, 1876, the State of California patented a very large tract of land to Mr. J. P. Whitney. This large tract included the Parcel; see Exhibit 3B. For this and other relevant deeds, the exhibit includes our mapping of the deed.

On January 17, 1877, Mr. Whitney transferred a portion of the land patented to him to Mr. Morton C. Fisher; see Exhibit 3C. These transferred lands included the Parcel and were generally those lands east and south of what was know as High Ridge Levee/Duck Slough.

On March 15, 1877, Mr. Fisher transferred his lands to James Stewart, James Burton, and James King; see Exhibit 3D.

On April 28, 1891, Stewart, Burton and King transferred their lands to Mr. Joseph Vasquez; see Exhibit 3E. This transfer separated the parcel from any surface connection to the main waterways of the time, Middle River, San Joaquin River, Burns Cut-off, or Whiskey Slough. This Vasquez land (which included the Parcel) abutted what was then labeled as a "cross levee." However, earlier deeds described this line as ". . . the levee constructed along High Ridge and Duck Slough. . ." see, for example, the language in Exhibit 3D. The last deed I have mapped created the parcel in its current size and is attached hereto as Exhibit 3F.

Of further note in this 1891 deed is the language "*Together with all and singular the tenements, hereditaments and appurtenances thereunto belonging, or in any wise appertaining, and the reversion and reversions, remainder and remainders, rents, issues and profits thereof.*"

The Vasquez land remained the same size as when it was first created until it was subdivided. This subdivision created two parcels, one of which is the Parcel; see Exhibit 3G. The Mussis became the owners of the Parcel by way of deed from Milton Welser, as Trustee (of his own Trust) dated June 7, 1999.

I have also prepared further exhibits which provide additional historical background and facts as they may relate to the Parcel.

Exhibit 3H includes the San Joaquin County Assessor's maps for the years 1876 through 1919, with the years 1877, 1878, 1909 and 1910 missing. These records are from the Micke Grove Historical Society, which is not aware of the locations of the "missing" maps. The map for 1876, shows a "blue" line along what was known as Duck Slough/High Ridge Levee; see Exhibit 3I. This line stretches from Burns Cut-off all the way to Middle River. Other documents confirm and/or suggest this was the route of Duck Slough on Roberts Island. Based on my expertise in mapping and reading maps, I believe this line indicates that Duck Slough had water in it at the time the tax assessor map was drawn.

I would like to note the method by which the levees, such as the "High Ridge Levee" were created. To create a new levee or improve a "natural" one, soil must be piled up. The easy and economical source of such soil was the immediate area around and near the levee site. Hence, dredges (or even hand labor) would remove soil in the vicinity of the levee site and would pile it up on the existing berm or levee. The "borrow pits" which were the sources for this soil were commonly located along the route of the levee. When the levee followed an old slough, it was common for the soil to be taken from the slough. The removal of soil deepened/widened the existing slough channel as soil was removed to build up the levee. We know that in this particular area, due to the depth to groundwater, digging a hole/trench/canal immediately results

in the channel filling with water seepage. When this was done to an existing slough, it created a larger source of open water fed from the main channel to which the slough connected.

In this case, we actually have a written source which confirms this enlargement of the slough abutting the Property. One of the early dredges (which were "floating steam shovels"), the *Sampson*, was actually used to create/improve the High Ridge Levee. The *Sampson* and its sister dredge the *Goliath*, were launched in 1875.

The *Sampson's* first job was on Duck Slough and Burns' Cut-off levees of Roberts Island (FN), but the water was so low that the equipment could not make headway unless a channel 30 by 7 feet was dug.

The footnote from the above quote states:

The levee followed the right bank of the slough southwestward toward Middle River from the slough's outlet on Burn's Cut-off. The present Honker Lake Tract, the Pocket, and Roberts Island north of the Santa Fe right-of-way (including McDonald Island) would be north of the levee.

This quote is from *The Settlement Geography of the Sacramento-San Joaquin Delta, California*; at page 267. Exhibit 3J is the entire document, and Exhibit 3K is the subject page.

This description in the *Settlement Geography* confirms the process of using the slough itself as the borrow pit, and the deepening of the slough along High Ridge Levee; Duck Slough. Such deepening was necessary to transport the floating dredge which was improving the levee.

From this I conclude that from very early on (1875), Duck Slough (abutting the Parcel) was improved to the extent the Slough became a substantial waterway (with the very approximate dimensions of 30' wide by 7' deep).

Exhibit 3L is another of the Assessor's Maps, this one dated 1881-1882. As we can see, it includes a "blue" line along the dotted lines. I interpret these marks to be the Assessor's notation of both the High Ridge Levee and Duck Slough. Again, the Parcel abuts these features.

Exhibit 3M is the *Map of a Portion of Roberts Island* dated 1883 (owned by M. C. Fisher and produced by Tucker & Smith, Civil Engineers, Stockton) This map shows a hashed line which represents a levee (labeled "Cross Levee") from Burns-Cutoff (a portion of the San Joaquin River south of Rough and Ready Island) running, generally, southwest down to Middle River. In addition to the dashed levee line, there is also a solid line running along the same route. This line indicates a smaller waterway (as opposed to the larger waterways indicated by two solid lines). Thus we have an interior island slough which connects the San Joaquin River to Middle River. This supports the conclusion that the blue line on the 1876 Assessor's parcel map indeed represents a waterway. This slough and levee are the dividing line between Middle Roberts and Lower Roberts. Again, the Mussi Parcel abuts High Ridge Levee/Duck Slough.

Exhibit 3N is the *California State Engineer Department Topography and Irrigation Map of San Joaquin County*, dated 1886. This map shows Duck Slough running from Township 1 North, Range 5 East, Section 12, Mount Diablo Baseline and Meridian to Township 1 North, Range 5 East, Section 27 Mount Diablo Baseline and Meridian. The Parcel is in the middle of Section 27 and abuts the Duck Slough line on this map.

Exhibit 3O is the 1894 Stockton-Bellota Drainage District map produced by the California Commission of Public Works. This map also shows Duck Slough extending from Burns Cut-off.

Exhibit 3P is the *USGS Holt Quadrangle Map* of 1911. This map includes coloring of known waterways. As can be seen, the USGS noted that a waterway existed in this same Duck Slough, with water reaching also down into Section 27. It is evident from the contours marking depressions along the east side of High Ridge Levee that a wet slough was present along the length of the High Ridge Levee, although not all portions of the slough were drawn with blue ink on the 1911 USGS Holt Quadrangle Map of 1911.

Exhibit 3Q is the *Map of California Delta of the Sacramento and San Joaquin Rivers* compiled by Captain Weathers and Captain Petzinger, and dated 1921. This map is important because it locates a major interior island slough that appears to open/connect to Middle River. This large slough does not reach the Parcel, but it is very near to it, reaching from Middle River northward to the old site of the Kingston School (founded no later than 1881). Confirming this large interior island slough, is the 1941 *Map of Lands Served by Woods Irrigation Company* attached hereto as Exhibit 3R. As we can see, even as late as 1941, there was a significant interior island slough in this location, meaning that water was available for use on the lands in the area. This slough, according to the 1941 map runs all the way to Trapper Slough.

Exhibit 3S is the *Denny's Pocket Map of San Joaquin County*, dated 1913. Besides showing cities and Sections, the map's legend indicates it also identifies "Roads, Private Roads, Railroads, Electric Railroads, Creeks and Ravines, *Canals*, and County Boundary Lines" (emphasis added). Clearly identified as a "canal" or "canals" are lines which follow Duck Slough/High Ridge and the slough running to and past Kingston School. These are connected by a short east-west canal from the School's location to approximately where the USGS and State Engineer Department maps show water in Duck Slough.

This interconnection between the slough running up from Middle River to Kingston School and the old Duck Slough is confirmed by the 1976 Department of Water Resources Areal Geology Sacramento-San Joaquin Delta map, attached hereto as Exhibit 3T. This map clearly shows that the water from Middle River is connected to the water in the slough abutting the Property, even as late as 1976.

I conclude that the two sources of water (Duck Slough and the slough running past Kingston School) were connected to the Parcel. Based on the *Denny's Pocket Map of San Joaquin County's* (Exhibit 3S) use of the term "canal," this water was intentionally provided to the lands along these waterways. As we see, these sources of water run directly by, and abut the

Parcel. Any contrary conclusion is not supported by the facts. Since we know that the Kingston School slough existed through at least 1941, it is logical to conclude that water could be distributed through all the connecting canals.

I refer back to the description of the Sampson dredge's activities in building a levee along Duck Slough and its "creation" of a 30' wide by 7' deep channel to allow the dredge to float and be moved. The combination of designated waterways, enlarged waterways, interconnection with other waterways, canals and sloughs many years before the Parcel was separated from the main channels to many years after, the only reasonable conclusion is that the Property maintained a connection to the neighboring waterways and thus was *not* severed as of 1891.

For ease of reference, we have included Exhibit 3U which combines a number of references to water sources onto a map which also shows the outline of the Parcel.

I have also reviewed the testimony of Michael Robinson which indicates that the Parcel received water from Woods Irrigation Company sometime prior to 1925. He also states that in 1925, the current supply system was formalized, though it had functioned (supplied water to the Parcel) before that date.

The evidence for the Mussi Parcel is overwhelming. Not only do we have numerous sources showing Duck Slough having water in it well past the date the Parcel was separated off from the main channels, we have water in it at least as of 1911, then in 1913 (the Denny's Pocket Map) we have canals along Duck Slough and connecting to a slough that existed through 1941, and supply by Woods Irrigation Company up to the time the current system was installed. There can be little doubt the owners of the Parcel maintained a continuous connection to water for irrigation purposes from 1891 through the date of their current supply system used today.

The second part of my testimony deals with the historical irrigation and drainage practices of the area. Attached hereto as Exhibit 3V which is a copy of my testimony before this Board in the Term 91 ACL hearings held in February, 2003. I will only briefly summarize that testimony now, and can provide more detailed explanations/clarifications when called as a witness.

Briefly, the area in question, like much of the Delta was originally designated Swamp and Overflowed Lands during the original federal surveys of public lands in California. This designation was due to flooding that occurred during times of high flows on the San Joaquin, Sacramento, or other tributaries to the Delta. This regular process created innumerable waterways stemming from the main channels, including large sloughs, small sloughs, and smaller dendritic channels.

The banks of the channels were the natural high ground due to sedimentation of the materials carried by the high flows. The first farmers in the area used these high grounds locate their buildings and for farming. These farmers then attempted to construct levees to protect their lands from the high flows and to drain them (as necessary) for full reclamation. In this process, the natural high grounds along the sloughs and other channels were generally used as the foundation, or beginnings of the levee. This explains why many of the current surface features in

the area are not straight lines, but followed the meandering courses of current or historic waterways.

As levees were constructed around the lands in the Delta, interior channels were dammed at the point they intersected the levee. At these dams they installed sluice or flood gates so that they could regulate the water in the slough being severed by levee construction.

The flood gates were constructed for two main reasons. The slough was used to drain the lands as necessary. This was done by allowing seepage to fill the slough, and then open the sluice gate during the low tide. Under those conditions, the slough would drain into the main channel and the desired drainage of the land was accomplished. The second purpose of the sluice gate was for irrigation. By opening the gate during high tide or high flow conditions, the slough would fill with water. This water was either pumped out of the slough, allowed to flow over the lands via natural gradients, or simply held in the channel to sub-irrigate the lands. The method used depended of course on the topography, and the extent of the improvements the landowners had installed and operated. Whichever method was used, the farmers certainly took advantage of this system and these capabilities because the application of water vastly improves crop production and minimizes the vagrancies of weather and river flow.

Since the southern Delta is mostly higher elevation than the central Delta, the sluice gates on old sloughs were probably used for irrigation more than drainage. However, the southern Delta does have a high water table (directly connected to the water in the neighboring channels and the elevation of that water) and thus did require regular drainage.

As time passed, the farmers installed more modern and efficient systems, including pumps and the sluice gates were slowly replaced. They also eventually filled in the sloughs and so replaced them with smaller canals or pipelines.

This description of reclamation and irrigation practices in the Delta is not speculation. Besides the numerous historical references to these practices (both cited in my Term 91 testimony and in Mr. Nomellini's testimony) I have personally been involved in levee projects which have located, removed or filled in at least four (4) of these old sluice gates. In fact, I believe Mr. Nomellini's testimony identifies others still in operation. I have also had many conversations with local farmers who either knew of these gates and the practices I have referenced, or actually were involved in the operation of these gates.

There are other relevant circumstance pertaining to the Parcel. From both the USGS map referenced above and the materials cited/used by Mr. Lajoie, we see that the Parcel is at or below sea level, both as of the time it was separated from having a surface connection to the main channels through the present. This means that it was, and remains directly connected to the main channels of the Delta. When high flows or high tides occur, any old channel or slough fills to the same level as the neighboring channel. Before the Parcel was fully protected by levees, the water would inundate the land, both through surface and subsurface flow. After the construction of levees for reclamation purposes, the subsurface flows continue to saturate the reclaimed land.

This area in general, and the Parcel in particular, operate drainage systems to deal with this saturation.

As you can in Exhibit 3V (specifically section II., Exhibit "G") which is my testimony submitted in the Term 91 hearings, the surrounding groundwater is directly connected to the waters in the neighboring channels. As I stated in that proceeding:

This hydrologic conductivity is important to understand the local water supplies. The entire Delta is one big pool of water; some in the channel and some in the soils. There is no net difference in the amount of water in the Delta channels when local diverters take from neighboring channels, pump from shallow groundwater, or farm crops which draw from the shallow groundwater. Taking water from one place is virtually the same as from another. This is especially true during summer and fall months when the three tidal barriers are in operation as they hold high tide waters around Upper Roberts Island and thus prevent any depletion of the channel waters from causing low levels which might affect other diverters.

In conclusion, the pertinent records indicate that as the ownership of the Parcel changed over time, it was always either abutting a channel, or connected to a supply system which could deliver water to it.

TESTIMONY OF CHRIS NEUDECK

I am Christopher H. Neudeck, P. O. Box 844, Stockton, California 95201. I am a registered Civil Engineer in the State of California and have worked with the Delta Islands including flood control, drainage and irrigation for the past twenty (20) years. I am the District Engineer for numerous reclamation districts in the Sacramento/San Joaquin Delta (Delta) and I am familiar with the history of reclamation of lands in the Delta including the Upper Division of Roberts Island which is the area of concern in this proceeding. The engineering firm of Kjeldsen, Sinnock & Neudeck, Inc. of which I am a principal is the engineer for Reclamation District No. 544 which encompasses the area of concern and adjoining districts Reclamation District No. 17 and Union Island Reclamation Districts 1 and 2. I am very familiar with the area including the waterways, levees, drains and irrigation facilities. A statement of my qualifications is submitted as a separate exhibit.

I. The Sacramento/San Joaquin Delta of which the upper division of Roberts Island is a part is the area where the Sacramento River system and San Joaquin River system merge and interface with tidal water. At the early times most relevant herein (mid 1800's), the area was recognized as swamp and overflowed land. The area has been described as the "Holland of America" where the deltas of the two river systems overlap. Like the branches of a tree, the river systems merging in the Delta divided and redivided into hundreds and perhaps thousands of channels which then rejoined into a single channel passing through the Carquinez Straits. (Exhibit "A".) These dendritic channels distributed the sediments suspended in the river flow. Heavier particles such as sands would settle closest to the channels resulting in a bank or area adjacent to the channel which is higher than the adjoining land. These bank areas rimmed tidal swamps with a gradient falling away from the channels. The gradient has over time been intensified by oxidation and deflation of drained peat, compaction and burning. (See Exhibit "C," The Settlement Geography of the Sacramento-San Joaquin Delta, pages 290-294.)

Prior to the construction of levees, the river flow would pass over all of the lands and dendritic channels for a number of months of most years. The entire area comprised the bed of the river with a variable depth. Water would be shallowest over the channel bank area. During periods of low river flow, water would essentially flow only through the dendritic channels.

In order to reclaim the swamp and overflowed lands, levees and floodgates were constructed to drain the lands. Although initially piecemeal and relatively small scale, the reclamation process evolved into a large scale effort. As relevant to Upper Roberts Island, the large scale effort commenced prior to June of 1879 (See Exhibit "B", Daily Evening Herald, June 27, 1879.) Levees were eventually constructed along the major channels now called the San Joaquin River, Old River, and Middle River. I have seen references to Old River as Old San Joaquin River and to Middle River as the Middle San Joaquin River.

Construction of the levees involved crossing or damming a number of the dendritic channels of various sizes which commonly are referred to as sloughs. The common practice was to install floodgates (a conduit with a mechanism for closure) in the levees (dams) at the point of crossing to provide for drainage and/or irrigation. (See Exhibit "C", The Settlement Geography

of the Sacramento-San Joaquin Delta, pages 244 and 245, which describes the general practice of damming sloughs and installing sluiceways which I call floodgates.) The floodgates of course would be closed at times of high river flows. Many were equipped with flap gates on each end so that tidal pumping could be used to enhance drainage or irrigation. In the case of irrigation, the flapgate on the inside of the island would open on the incoming tide and close on the outgoing tide, thereby helping to maintain a full slough or ditch to improve the distribution of water to the various fields. Early floodgates included a variety of conduits. Some were rectangular pipes or boxes made of redwood, brick, or cement and others were riveted steel pipes or clay pipes. There are a number of floodgate and slough-type irrigation facilities still operating in the Delta. On Upper Roberts Island, all appear to have been replaced by irrigation pumps and pipelines and drainage pumps and canals. In some cases, drainage pumps discharge water into the irrigation pipelines which direct the water by way of backflow to the river.

Impacts on irrigation season water levels by water development and channel dredging, the need for more efficient irrigation and drainage practices and the desire to improve levee integrity are obvious factors which encouraged the shift from the slough and floodgate gravity systems to pumps, ditches and pipelines on Upper Roberts Island.

Exhibit "D" is a 1912 Topographic Map of Upper Roberts Island on which I have plotted what I believe are the dendritic channels in the area of Upper Roberts Island which abut the properties which are the subject of this proceeding. The channel locations are confirmed by aerial photos of the area on which the sedimentary soils deposited along the dendritic channels is reflected as the lighter colored area. (See, for example, Exhibit "E".) Although these channels do not at the present convey surface water to the subject properties, they do continue to serve as conduits for the river water to pass below the ground surface to such parcels. It is my opinion that such channels conveyed surface water to the subject parcels from at least 1850 until the time that replacement irrigation facilities were installed. As discussed hereinafter, there are still remnants of such channels, floodgates and other irrigation facilities which confirm the use of irrigation water and the lack of severance for the subject parcels. The passage of time has tended to mask the existence of historic sloughs. Meandering roadways and property lines have been straightened, sloughs have been filled and replaced by ditches and pipelines and floodgates have been removed to reduce the threat of levee failure. Farmers have "squared up" and leveled their fields. In many cases, the upper portions of the slough sediments were removed and exported or mixed with adjoining soil to make farm field soils more uniform.

With minor exceptions, all of the lands within the upper division of Roberts Island have from the time of reclamation been devoted to farming. The need for and use of surface water for growing crops has always been of paramount importance. Extending back even before the time of patent of lands by the State, the landowners and farmers on Roberts Island including Upper Roberts Island were beneficially using the surface water to grow crops. While at first beneficial use was limited to the moisture gained from natural overflow of the land to be planted to crops irrigation with surface water soon followed.

"Some irrigating had been done earlier, but the practice does not appear to have become a common part of delta farming until the 1870's. Flood irrigation had been tried on small grain by 1871, but was given up because of the excessive

weed growth that resulted. For other crops land soaking before planting or flood irrigation were practices in use during the 1870's. Subirrigation prior to plowing and planting dates from the same decade; it was originally used for beans and potatoes or to encourage the growth of a volunteer hay crops. Since then subirrigation has been used on all growing crops.

Irrigation water was delivered to the backswamp land through tidal gates and drainage ditches in the 1870's. Filled mains backed water into field ditches of two- to four-foot depth; from these the water spread along the six-inch- to two-foot-deep laterals ("spud ditches") which were spaced at intervals of 65 to 85 feet. Seepage occurred in the peat soils. Water levels were controlled with dams across the ditches.

Water delivery systems independent of drainage ditches were in use by the latter 1870's. These systems were maintained by the farmer, only the drainage system being the responsibility of the reclamation districts. Water wheels, windmills, and low-head pumps were used on the higher alluvial banks where furrow and check irrigation were the rule. Gravity flow and siphons after the 1900's were used on the lower tracts. . . ." (Exhibit "C," The Settlement Geography of the Sacramento-San Joaquin Delta, pgs. 310 - 312.)

"The conversion of natural levees into farm land on Roberts Island may be credited to Chinese lessees who, at least by 1869, were establishing truck and fruit gardens on the San Joaquin River side of Roberts Island. South of Rough and Ready Island the cleared land had become an almost continuous series of 6- to 50-acre cultivated plots by 1875. The farmed strip stretched into the island 200 to 500 feet. Another 60-acre strip of cultivated levee was located on the west side of the island to the north of the Pescadero Grant line. Here and there along the levee were the homes and barns of a dozen white families, chiefly grain and bean farmers and stock owners. Scattered clusters of Chinese gardeners occupied the Grant land. Like the renters to the north, the Chinese raised onions, beans, and blackberries.

Once the land development companies began to reclaim the backswamps in the 1870's, the land use pattern changed. Extensive grain fields appeared over the interior of Roberts Island. The white lessees were mainland residents as well as island settlers. Most of the latter lived within a mile of the river; their houses occupied slight alluvial prominences amidst the grain fields. Some of their farm structures had been built by the land developers as base camps for the reclamation and land clearing crews. In addition to the expansion of grain fields over the interior of the island, an enlargement of bean and potato acreage occurred near the river, where the thrifty Chinese and Italians even planted on the artificial levee. A few small deciduous orchards were scattered around the higher periphery too." (Exhibit "C", The Settlement Geography of the Sacramento-San Joaquin Delta, pgs. 322-324.)

Attached hereto are copies of historic newspaper articles supporting the above.

Exhibit "F" is an article from the Daily Evening Herald for May 12, 1879, titled "A Trip to Roberts Island". In addition to the verification of the farming activities, the article reports the irrigation facilities and floodgate of Matthews & Lowry.

"Messrs. Matthews & Lowry, who own a portion of this section of the island, have placed a flume through the levee with the intention of establishing a thorough system of irrigation on their land, if they are successful in making this flume, which is quite a large one, capable of carrying several thousand inches of water, work."

The referenced flume appears to be located in the same area as the dendritic sloughs which I have identified along Old River.

Exhibit "B" is an article from the Daily Evening Herald for June 27, 1879, titled "Crops and Prospects on Roberts' Island". The article verifies crop production and further provides:

"Roberts Island is rapidly assuming the appearance of a settled and prosperous community. It requires no stretch of the imagination and no confidence in the improbable, to picture this Island as the most prosperous part of the county, and the very garden spot of the State."

The garden spot vision for the area confirms the lack of evidence of any intent of any of the landowners to abandon their rights to obtain water to grow crops.

II. I was also asked to investigate the relationship between the shallow subsurface water under Upper Roberts Island and those of the neighboring channels. I have extensive experience with this issue. Over the years of my engineering work in the Delta, I have dealt with flood waters, seepage, and drainage issues. I testified on this issue in the Delta Wetlands hearings before the Board.

For the area of concern, Upper Roberts Island, DWR has a recent study which resulted in that agency producing Exhibit "G" entitled "Reclamation District 544 Seepage Monitoring Study 2000 - 2001." This study confirms my prior conclusions that due to the subsurface soils, there is a direct connection between the shallow groundwater and the waters in the neighboring channels. When the river goes up, the groundwater goes up and vice-a-versa.

This hydrologic conductivity is important to understand the local water supplies. The entire Delta is one big pool of water; some in the channel and some in the soils. There is no net difference in the amount of water in the Delta channels when local diverters take from neighboring channels, pump from shallow groundwater, or farm crops which draw from the shallow groundwater. Taking water from one place is virtually the same as from another. This is especially true during summer and fall months when the three tidal barriers are in operation as they hold high tide waters around Upper Roberts Island and thus prevent any depletion of the channel waters from causing low levels which might affect other diverters.

I therefore conclude that if these four diverters which are the subject of this hearing were forced to shift to shallow wells for irrigation, or farm crops which had root zones reaching to the shallow groundwater, there would be no difference in the amount of water available in the surrounding channels.

III. I will now examine each of the four diverters' property separately. It is important to note my examination is also based on and includes the facts and conclusions stated earlier in my testimony regarding the history of Upper Roberts Island. I understand that the designation of riparian or pre-1914 rights is a conclusion to be made by this Board and/or the Courts. For my purposes, I have investigated to determine the facts relevant to the sociology, history, and engineering for the diversions which counsel informed me is relevant to the determination. Many of my exhibits are the patents, deeds, or other recorded documents contained in Mr. Pankey's exhibits of title documents. Of further relevance to these individual pieces of property are the facts stated earlier in my testing regarding the history of Roberts Island as well as the information contained in Exhibit "H" which includes biographical excerpts from the "History of San Joaquin County" dated 1923.

The Silva property is 169.92 acres. As we can see from the title documents, the Silva property was being purchased and sold before it was patented from the State. The early Deed (dated 1875) describes a large portion of upper and lower Roberts Island, including sections 1, 2, 12, and 13 in Township 1 South, Range 5 East, and portions of Sections 5, 6, 7, and Section 18 in Township 1 South, Range 6 East. The first map of Exhibit "P" has these sections highlighted and shows the property connected to Middle River (it is also connected to the San Joaquin River near Rough and Ready Island). By this date, substantial reclamation had been done, and as I stated earlier, the clear purpose of ownership was to farm the land.

The next deeds include the same acreage continuing the connection of property to Middle River and include such things as half interests being conveyed back and forth. During these times, there were typically floodgates connecting the sloughs to the waterways in order to irrigate the land of the island. Exhibit "J" includes a photo of an old floodgate just upstream and up slope of the Silva property. The control structure on the end of the floodgate is dated 1923, but the floodgate itself was likely in existence prior to that time.

The topographical maps indicate that water from this floodgate would indeed allow the periodic flooding and/ sub-irrigation of the Silva parcel, the common practice during the era. The names on the deeds are those of farmers indicating use of land for farming; the price of over \$22,000 also indicating something other than bare, unused land.

The patent dated 1876 to Whitney also includes the Silva property (Township 1 South Range 6 East West one half, North East one quarter, and West half of South East one quarter of Section 6) which still retains a connection to Middle River. Deeds through 1891 continue to include Mr. Silva's property. The 1891 Deed from Easton to Woods now shows how the property is included in the description of lands that eventually becomes the Woods Irrigation District on Lower Roberts Island. The Deed clearly shows the continued connection to Middle River.

The next title document is dated 1909. We therefore have at least 37 years of probable farming on the land which as per my earlier testimony means that the organic soils have mostly been burned off leaving a more irregular landscape with the (now) high points being the areas along the sloughs. No evidence was found to indicate if or when the sloughs were no longer used for irrigation.

In 1909, the owner died and his estate is distributed through the court (Exhibit "K"). The property of the estate includes the Silva parcel and numerous farming equipment, draft animals, and other livestock.

Next we have two agreements each dated September 29, 1911. The first allows the owners to construct, operate, etc., canals for irrigation and drainage. This indicates to me the clear continuation of the application and use of water by farmers on the property. The next agreement is to actually provide the water to various parcels. This would indicate that the Woods Irrigation District had at least partially completed its delivery system using its current points of diversion on Middle River at a point just downstream of the old floodgate I have previously identified. (Exhibit "L.")

At the time of these agreements, the Silva property is described as Lot No. 22 of the Wilhoit-Douglass Tract. The agreement confirms my earlier conclusion by referencing portions of the property as "high lands" or lands along a slough. The agreement recognizes the ability to sub-irrigate or to pump water onto the land from the Woods irrigation facilities which follow a downstream slough with a lower elevation than the slough area of the Silva property. The reasonable conclusion is that the land was flooded from the sloughs and/or the identified floodgate when possible to assist grain production or promote grazing grasses.

A Deed dated 12/28/11 appears to be the first time the property is possibly disconnected from Middle River. In that Deed (Exhibit "M"), Lots 21 and 22 are transferred. It is important to note though that Lot 21 borders the main irrigation ditch of Woods Irrigation District; evidence which, along with the above-described agreements, shows intent to retain the ability to get water from Middle River. Additionally, there is no evidence that the right to receive water through the floodgate and slough was terminated. This same property (Lots 21 and 22) are transferred through a probate in 1915.

In November of 1915, there is a partition decree separating parcels 21 and 22. Of interest here is the fact that the person who gets parcel 22 also has an oral lease on Lot 21, which contains "tenant crops" (Exhibit "N"). It is likely that both parcels are therefore still under agriculture for at least pasture with flood irrigation when possible. We should note that the property still retains the ability to receive water from the Woods Irrigation District pursuant to the 1911 Agreement.

Next we have two documents recorded on the same day in August of 1941 (Exhibit "O"). One is a sale/purchase and the other is an agreement. The agreement allows the Silva property to install a pipeline over its neighbor to the west in order to get irrigation water from Middle River. The sale document requires the owner to finish leveling the property and irrigate that which he levels. Given the language contained in the document of "land not theretofore leveled and

irrigated," it is clear that the land was being irrigated before this time. This is also confirmed by my review of aerial photographs of portions of Roberts Island which show most of the Silva property under cultivation.

After 1941, the legal description changes slightly as the parcel had a lot line adjustment to resolve the issue of a barn on the property line. This slightly decreased the acreage of the Silva property.

My investigation confirms that since this 1941 agreement, the land has been continuously irrigated and farmed with crops of alfalfa, grain, tomatoes, asparagus, etc.

I therefore conclude the following:

1. The Silva property was originally part of a parcel abutting Middle River and at the time of disconnect, the intention of the owners to retain the ability to receive water from Middle River is clear and recorded by agreement;
2. Before and after reclamation of this portion of Roberts Island, the Silva property abutted an unnamed slough off of Middle River, which slough possibly also connected to the San Joaquin River; and
3. It appears that the land has been continuously supplied with water from Middle River since the mid-1870's through the present for irrigated farming

RATTO (Golden R, Inc.)

The Ratto property is approximately 55 acres located generally as the Northeast Quarter of the Northwest Quarter of Section 18 Township 1 South Range 6 East. It was included in the patent of 1876 from the State of California to Mr. Whitney (page 1 of Exhibit "P"). As before, this patent included large tracts of land on both Upper and Lower Roberts Island, which lands connected to both the San Joaquin River and Middle River.

Subsequent Deeds maintain the connection with the Middle River until 1891 when in 1891 the owners Stewart, et al., deeded to Small the current sized parcel, officially described in measurements in chains and links, but generally being the same Northeast quarter of the Northwest quarter referenced above. (See page 3 of Exhibit "P".)

Exhibit "Q" are selections from a book entitled, "The History of San Joaquin County" originally published in 1879. The first part of the Exhibit is a map which shows an interior island slough running up through sections 18 and 19 of One Township South Range 6 East. From the map, one would conclude that the Ratto parcel abuts the slough. To confirm this, I investigated early surveys and found one dated 1903 (Exhibit "R") which appears to be the same slough, but not reaching all the way to the Ratto property. This makes sense in that over time the sloughs were filled in and the ground itself farmed and irrigation practices moved from the use of sloughs to ditches and/or pipelines and eventually pump diversions closer to the main waterway. My investigation also confirmed that this slough had a floodgate used to regulate high flows and

tides in the slough to facilitate irrigation. The existence of the floodgate confirms that interior island farming using slough waters was occurring in this area.

A later survey in the San Joaquin County records shows that an irrigation ditch continues on from the 1903 surveyed slough, apparently along the tract of the slough referenced in the 1879 book; again confirming my earlier testimony about agricultural practices in that farmers typically used existing waterways for their irrigation.

Also in the 1879 book is an illustration of the property of M. C. Fisher. The illustration I believe includes the Ratto property. Although the illustration does not have the slough running north-south which appeared earlier in the book, it identifies a "Willow Slough" running approximately east west. The significance of this illustration is that it shows ongoing farming and a slough to the farm land. These confirm to me that at least as of the date of the illustration, the subject property is being farmed and irrigated in accordance with the agricultural practices of the day; well prior to being physically disconnected from Middle River. Grain crops and pasture appear to cover most all of the land. Also attached is Exhibit "S", a May 19, 1882, Article from the Daily Evening Herald which mentions a Willow Slough Dam, further confirming the use of these sloughs for irrigation.

I don't ascribe any real concerns for the failure of the drawing to show the north-south slough or the failure to show any irrigation improvements. The location of the cross levee and the proximity of the San Joaquin River both indicate the illustrator had a general but not perfect sense of the geography of the area. Nonetheless, I believe it is valuable evidence of ongoing practices at the time.

I next note that when the above-referenced owner Small died, his estate included farming equipment which would be used for the type of farming shown on the illustration, as well as livestock which would be raised for and used as power in the farming operation (see Exhibit "T"). I believe this is another clear indication of the ongoing farming practices of the day.

The next relevant title document is the grant of an easement in 1917 (Exhibit "U"): This document tells us that PG&E will indemnify for any damage to any "crops, cattle, stock . . ." Though only a small reference, it constitutes the specific evidence of activity on the land, and I therefore conclude the property was still being irrigated and farmed via flood gates from sloughs. A later easement for PG&E in 1930 (Exhibit "V") also references the requirement to not interfere with the Grantor's use of the land for "agricultural purposes."

The next relevant documents include three Indentures dated 1964 whereby the owners of the Ratto property enter into agreements to confirm and allow the use of irrigation pipes, etc., to supply water to the subject property over neighboring parcels. Three documents were required as the water is passing over more than one other parcel in its connection to Middle River. Importantly, the one document (Exhibit "W") references that the right of way granted follows "an existing Irrigation Ditch . . ." and an "existing concrete irrigation pipeline." When I trace these existing improvements, I note that they abut the Ratto property. This indicates to me that the water ran to the property before this right-of-way was officially granted. Since it appears the

property was always farmed, the reasonable conclusion is that the documents memorialize an ongoing practice.

Subsequently, the current owner confirms that the property continues to be irrigated and farmed the crops of alfalfa, corn, safflower, wheat, etc.

I therefore conclude the following:

1. The Ratto property was originally part of a parcel abutting Middle River and at the time of disconnect, the intention of the owners to retain the ability to receive water from Middle River or Old River is clear and continuous;
2. Before and after reclamation of this portion of Roberts Island, the Ratto property abutted an unnamed slough off of Old River and likely one or more from Middle River as well (including Willow Slough);
3. It appears that the land has been continuously supplied with water from Middle River or Old River since the mid-1850's through the present for irrigated farming.

CONN

The Conn property consists of 161 acres, which includes a 41 acre parcel and a 120 acre parcel. This property was also deeded a number of times before being patented from the state. The two parcels were originally in two different patents.

The first Deed includes Sections 1, 2, 12, and 13 in Township 1 South Range 5 East and portions of Sections 5, 6, 7, and Section 18 in Township 1 South Range 6 East. As before, this shows the 41 acre Conn parcel being originally connected to Middle River and the San Joaquin River.

The next five Deeds and the title documents transfer the same gross acreage back and forth until 1876 when Mr. Whitney, the last grantee on these Deeds, got a patent from the State of California. As shown before (page 2 of Exhibit "X"), this patent includes large tracts of land on Upper and Lower Roberts Islands. With regards to the Conn property, the patent includes the west half, northeast quarter, and west half of southeast quarter of Section 6. This generally includes the 41 acre parcel and not the 120 acre parcel. Two subsequent Deeds transfer this smaller of the Conn parcels, but the language is slightly different for a portion of Section 6. The Deed describes the north half and southwest quarter whereas the patent described the west half and northwest quarter. Though different, those descriptions outline a similar portion of property. Both the Deeds and the patent include the west half of the southeast quarter which is the smaller of the Conn parcels. This property continues to be connected to Middle River.

In 1887, another patent covering the 120 acre parcel was issued. Page 4 of Exhibit "X" shows that a Mr. McCloud received a patent in 1887 of just the east half of the southeast quarter of Section 6 and the southwest quarter of the southwest quarter of Section 5 Township 1 South

Range 6 East. This describes the "L" shaped parcel of 120 acres which continues to this date. As per my earlier testimony, there was no use for these Roberts Islands' lands in the 1800's except for farming and animal husbandry. It appears that after the initial deeding of the property in the 1970's, Mr. McCloud had occupied and used the 120 acre parcel such that the last person deeded the property before patenting, did not seek or get that property in his patent. Again, Mr. McCloud had obviously occupied and put the land to use to support his claim. This in combination with other information leads me to conclude that the land was used for farming at least as early as the 1870's.

As previously stated, I have located interior island sloughs which connected the 120 acre parcel to the San Joaquin River (see Exhibit "D"). Given the location of neighboring sloughs, it is likely this slough also connected to Middle River. These were therefore the source of irrigation water for the property. Similarly, the small parcel was likely connected to Middle River and/or the San Joaquin also.

Relevant to these conclusions is the Declaration of Peter Ohm (Exhibit "Y") previously submitted to the Board in support of these four diverters. Mr. Ohm died last year, but his Declaration states that these parcels received water prior to 1914 and probably prior to 1900 via a terra cotta pipe connecting with the San Joaquin River. I have investigated the site and found a portion of the pipe to confirm Mr. Ohm's testimony. A picture is attached here to as Exhibit "J".

The piece of pipe corresponds to the current cross island levee which separates Upper Roberts from Lower Roberts Island, which has been referenced in many of the Deeds describing the Silva and Conn properties. The location of this piece leads me to conclude that the pipeline ran along this feature and thus likely supplied both the Conn parcels from their southern border, it being the up slope side. My investigation confirms that the use of a terra cotta pipe suggests pre-1900 installation. Generally, prior to 1900 various materials such as terra cotta and brick were used to carry water as they were cheaper and locally produced. Use of cement pipes being more common thereafter.

Nearby this site are the remnants of a pump diversion (also located on the map) which the landowner has left in place as "proof" of pre-1914 diversion and use of water. The materials used include cement piping and since the owner places its installation between 1900 and before 1914, further support is given to my dating of the terra cotta pipeline.

One additional confirmation of the irrigation and farming of this land is an 1887 Deed of the 120 acres (Exhibit "Z"). This Deed includes a notation of an existing crop to be harvested and split between the grantor and grantee.

Subsequent transfers combined the two parcels as well as property which included the Silva parcel as of 1951; all of which were owned by a party named Avila. Eventually there was some sort of lease agreement with a party named Silveria, a lawsuit, a bankruptcy, and a settlement agreement dated 1990. The settlement agreement confirmed and split the ownership of the Conn and Silva properties. For our purposes, I note that the settlement agreement requires the Deed to Mr. Conn's predecessor to include the language, "together with the appurtenant water rights and entitlements and a non-exclusive right to use all appurtenant irrigation and

drainage related easements" (Exhibit "AA"). I believe this clearly refers to the Saunders' (Exhibit "BB") easement for irrigation which is the current source/method by which the Silva and Conn properties receive water from Middle River. Apparently, the terra cotta pipe was abandoned when a joint owner made an agreement to get water from Middle River. It is clear from the Ohm Declaration and the current owner's knowledge that the parcel was continuously irrigated most recently from Middle River and prior to that from the San Joaquin River.

Subsequently, the current owner confirms that the property continues to be irrigated and farmed the crops of alfalfa, tomatoes, safflower, wheat, etc.

I therefore conclude the following:

1. The smaller Conn parcel was originally connected to both Middle River and the San Joaquin River, but at the time of disconnect from those waterways, the intentions of the owners to retain the ability to receive water from the San Joaquin River is apparent. The fact that the original patent separated the other parcel from surrounding lands and the main waterways, and that it was done during ongoing farming indicates an intent to keep access to the water of the neighboring channels;
2. Before and after reclamation of this portion of Roberts Island, both the Conn parcels abutted an unnamed slough off of the San Joaquin River and probably also connected to a slough which connected to Middle River; and
3. The land has been continuously supplied with water from both the San Joaquin River or Middle River since the mid-1870's through the present for the purpose of irrigated farming.

PHELPS

The Phelps' property consists of three parcels, one of 156.65 acres, one of 76.35 acres, and one of 157.75 acres. These parcels also show deeding before being patented from the state. The first Deed transferred two of the parcels to a Mr. Kidd in 1873 (see page 1 of Exhibit "CC"). My earlier testimony indicates these parcels were connected to a slough off of the San Joaquin River, and probably also off of Old River. The first patent (page 2 of Exhibit "CC") is to Mr. Kidd in 1874 and includes the west half of Section 8, and the east half of the west half of Section 17 of Township 1 South Range 6 East which generally describes two of the Phelps' parcels.

Mr. Kidd then deeded the property to Mr. Whitney who himself received a patent in 1877. This second patent (page 3A of Exhibit "CC") takes in Section 18 of Township 1 South Range 6 East which includes the third Phelps' parcel; all three now being owned by one person (Mr. Whitney) which at the time of this last patent, are connected to Middle River and the San Joaquin River.

All three parcels are subsequently transferred as part of a larger whole. In 1878, only the parcel in Section 18 is transferred to a Mr. Stewart disconnecting it from the rivers. In 1885, the

other two parcels are sold through a sheriff's sale to the Stockton Building and Loan Association (page 5 of Exhibit "CC"). All three parcels are then bought and sold separately until eventually combined under one owner.

Of importance is my conclusion that these lands were continued to be farmed throughout. At a location near the old Brandt Bridge (noted on Exhibit "D") on the San Joaquin River, there remains a brick pipe through the levee which in modern times was closed off and filled with cement. This brick pipe had a floodgate on it which again confirms the local farmer's efforts to control interior island flows for the benefit of agriculture. The common practices would indicate that the waters were used for either direct irrigation or subsurface irrigation. My investigation as well as the fact that the structure was of brick indicate to me that it was in use probably sometime in the 1890's and continuing thereafter. The irrigation off this brick pipe could have connected to the remains of the old sloughs nearby.

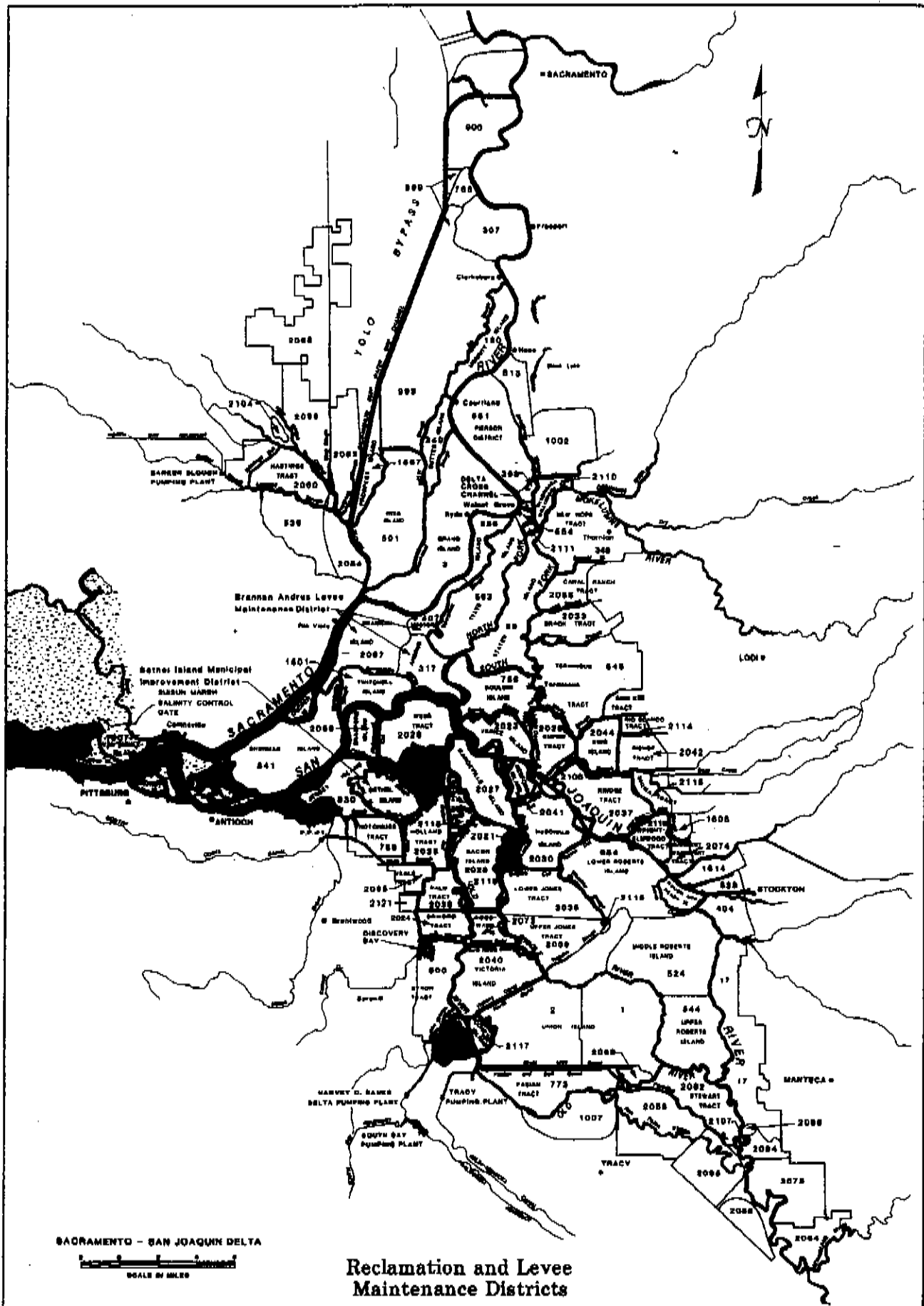
The various owners of these parcels are mostly well-known farming families of the area, again indicating the continued use of the land for agriculture.

The Phelps' parcels were eventually all acquired by the current Mr. Phelps' father. The final document of interest being the 1962 indenture which established the current method of delivering water to the property. The current owner confirms that the property continues to be irrigated and farmed with crops typically being of alfalfa, tomatoes, beans, wheat, cucumbers, asparagus, etc.

I therefore conclude the following:

1. The Phelps' property in Section 18, Township 1 South Range 6 East was originally connected to the San Joaquin River but at the time of disconnect, the intention of the owners to retain the ability to receive water from the San Joaquin is clear and continuous;
2. Before and after reclamation of this portion of Roberts Island, the Phelps' property abutted an unnamed slough off of the San Joaquin River which slough also likely connected to Old River; and
3. It appears that the land has been continuously supplied with water from the San Joaquin River since the mid 1870's through the present for irrigated farming.

Finally, I would like to note that my conclusions herein include my many years of experience in the Delta which has resulted in my exposure to many sources of people. It cannot be seriously asserted that anyone who owns and/or farms Roberts Island lands would intend through any sale a severance of the properties' ability to get water from the neighboring channels.



ATTACHMENT "B"

EXHIBIT "B"

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acres, having crops of wheat, barley and potatoes. The crops this year are generally good, although the degree of excellence varies from first rate down to very poor—the poor crops, however, being the exception and confined to spots of from three or four acres to one hundred acres, according to the time of seeding and the condition of the ground. On the northern half of this tract the land seeded was all new, never having been subsoiled, while on the southern portion crops were raised last year, the cost of tillage thus being naturally reduced and the certainty of a crop correspondingly increased. A very great obstacle in the way of subsoiling the lands and bringing them into cultivation were the tules, which it was both nearly impossible to kill with the plow and to prevent from burning up in the dry season. It was finally determined by Mr. Fisher to resort to fire to destroy the tules, as it was found that it was much safer to superintend the destruction of the tules in that way and have it done systematically than to allow the fire to burn when it happened to catch—as catch it would—and to try to plow down what were not burned. The latter plan has worked satisfactorily and a large part, if not the greater part of this division of the Island had been burned over. The fire only destroyed the tule sod and in no place burned deeply. The surface has been left level and clear, interspersed with occasional patches of tules in low places. These spots are to be burned before the second crop will be planted, and another year the landscape will present an unbroken prospect of waving wheat and barley.

This is now the case on all the Southern end of the tract, where, as far as the eye can reach, extend fields of grain ripe and ripening. All over the Island can be seen gangs of harvesters, and occasionally a gang of threshers, at work gathering the crop. The grain on land that was cultivated last year is very even of good growth and generally plump. In many places both the new as well as the old land has produced a bumper crop, and the harvest is well advanced. The grain, however, has not been cut, and the tules have not been subsoiled.

SHIPMENTS.—Sperry & Co. shipped 6,000 quarters of flour and 10 tons of bran; I. S. Bostwick, 65 tons of yarn; J. D. Peters, 4 bales of wool; L. De Blainville, 7 bales of wool; R. B. Lane, 500 quarters of flour; Pacific Tannery, a lot of hides, leather and glue stock; P. Musto and Shepherd Bros., poultry and eggs; T. A. Crawford, several hundred sacks of onions and potatoes by the steamer Mary Garratt.

DISAPPEARED.—Mr. J. E. Duff, formerly Railroad Agent at Stockton, but recently Auditor of the Eureka and Palisade R. R. Company, mysteriously disappeared from Eureka, (Nev.), some weeks since that his accounts are all right. He has gone to the Sandwich Islands, leaving his wife and child. He was well-to-do and highly respected, and his disappearance is unaccountable.

FLAGS FOR EVERYBODY.—Mr. D. S. Rosenbaum, the popular one-price clothier, is determined to please his patrons in some manner or another. He has a great number of American flags, and he has determined to make a gift of one to each of his customers. The flags can be obtained by calling at his store at the corner of Main and San Joaquin streets.

"OURS."—The Stockton Dramatic Society presented the military drama of "Ours" to quite a fair sized audience at the theatre last evening, playing for the benefit of the Stockton Guard, N. G. C. The indications are that there will be a much larger audience in attendance this evening, when the same play will be repeated.

PERSONAL.—The Sacramento Bee says Mrs. Laura De Force Gordon is reading law in the office of Raymond & Allen in this city. She intends to apply for admission to the Supreme Court next fall.

GRAIN FIRE.—It is reported that ten thousand bushels of grain were destroyed last night in Stanislaus county, belonging to the Warner Brothers and Mrs. Fagin. Loss not known. No insurance.

WASHER BROTHERS.—Professor H. O. Washburn of Washington College, will deliver a course of lectures on the law of the State at the Law Institute.

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...MELLINI GRILLI MOD... approached a publisher of one of the numerous seven-by-nine give-away weekly publications and made a proposition to take a half interest in the concern, saying that he was desirous of making it a "tri-weekly published twice a week." Unfortunately the offer was not accepted and journalism is likely not to receive the benefit of that young man's genius. The *Call* offers better inducements to writers of the "funeral obsequies," "events to transpire" and "tri-weekly twice a week" order of intellect than any other paper on the coast. Application should be made to Loring Pickering.

WHEAT.—The wheat receipts at the Centre street depot to-day, consist of 48 cars consigned as follows: Farmers' Union, 10; L. Bishop, 4; A. C. Paulsell, 1; W. G. Langdon, 1; Stewart & Derick, 4; M. Reynolds, 4; Stewart & Smith, 6; J. D. Peters, 6; J. W. Campbell, 1; I. S. Bostwick, 8. Stewart & Smith shipped 68 tons by the schooner *Travler*, 110 tons by the schooner *Arab*, 3 tons by the schooner *Rainbow*, and received 1,000 sacks by teams. J. D. Peters shipped 120 tons by the schooner *Onia*, 450 tons by the barge *Commerce*, received 2,000 sacks by teams, and 1,400 sacks of barley from up the San Joaquin river by the steamer *Alice*. I. S. Bostwick shipped 20 tons by the steamer *Mary Gerrard*, and received 1,500 sacks by teams. Wheat is quoted at \$1.35 to \$1.37.

OUT AND IN.—John Crowley and Charles Miller, two individuals arrested this morning by officer McCloud on suspicion, were taken to jail and searched. During the time they were detained by the officers they became very unruly, and thought that one had been blowing the other. It was agreed to settle the matter by installing in a general law field was not inclined to direct, but to bring the row to an end dismissed one of the workmen and held the other until he thought that thought was had elapsed to allow them to get out of sight. No sooner was he let out before they came together in the vicinity of the jail, and after punting each other for a while, were led

by the district NO. 2606 ab? 18/34 Kelly Little, "Old" Learned and one or two more intellectual giants who can see further into the Republican grindstone than "The-in-ances," to believe that that they ought to die in defense of their "principles" rather than neglect an opportunity of making themselves ridiculous by nominating a ticket which would have no show for an election. Perhaps some of the rank and file suppose that a regular Kearney ticket will be nominated, with "old" Learned for Senator. They are likely to be deceived, to be sold out; and if the statement of a prominent officer of the Workingmen's club is to be taken as reliable—and all their officers are honorable men—the bargain has already been closed. This officer stated yesterday that the Workingmen would endorse the Republican county ticket—or a great part of it. In return for this very considerable favor, the Republicans, he said, had agreed to furnish the Workingmen with funds to carry on a campaign sheet in defense of their principles, and to contribute money to aid in the payment of other campaign expenses. This would, it seems, ordinarily be sufficient to demonstrate the fact that the Workingmen's movement is now kept alive in other parts of the State and in this county, by the Republicans, who propose to risk San Francisco in the hands of the Kearneyites in the hope of electing the monopoly candidates to the important offices of the State and to the Legislature. The Workingmen's movement in this county has been managed for the last three months by Republicans, in the interest of the Republican party, through convenient tools. The Workingmen are sold out.

THE COURTS.

District Court—Hon. S. A. Brown, Judge
FRIDAY, August 2, 1879.
William Helmsman, trustee of Germany, admitted to citizenship on the testimony of A. Lutz and Chas. Buecher.
The Bank of Stockton vs. A. Easton—Defendant's demurrer overruled and defendant allowed 20 days to answer.
E. F. Sanders, administrator, vs. John Carman, Chas. Cortal et al.—Defendant allowed until Tuesday, August 10th, to file affidavit for vacation of hearing on motion for change of venue.

THE SETTLEMENT GEOGRAPHY
OF THE
SACRAMENTO-SAN JOAQUIN DELTA, CALIFORNIA

A DISSERTATION
SUBMITTED TO THE COMMITTEE ON GRADUATE STUDY
OF STANFORD UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN
GEOGRAPHY

By
John Thompson
December 1957

EXHIBIT "C"

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below tide water insuring saturation and volume maintenance. Under such conditions the peat is preserved, and remains as seepage-proof as oakum calked into a seam."¹⁵

Damming Sloughs

Prior to building levees on a tract it was common practice to dam the numerous sloughs by which it was drained. The dams were built on the levee line or slightly inward of it.¹⁶ In most cases, local fill was used in the structure, though piling and stone sometimes were added to give substance.

In some parts of the delta a larger cross section of fill was amassed in the dams than in the adjacent levees. On Union Island, for instance, dams were built three feet higher and four feet wider than the levees.¹⁷ Twelvemile Slough, in the present Wright Tract, was dammed in 1875 with a peat structure that had a crown width of 100 feet and a base width of 150 feet. The dam was given a freeboard height at high tide of 10 feet. These dimensions were considered adequate to stem the pressures of a channel 120 feet broad and 18 feet deep at high tide. Weight and shrinkage factors in peat

¹⁵wright letter to Williams.

¹⁶The earliest descriptions known to this writer are the reports of O. P. Beasley and J. M. Sidwell in Annual Report of the Surveyor General for the Year 1860, pp. 54-56.

¹⁷Henry M. Naglee, Letter to Wm. H. Hall and Board of Engineers of the State of California upon the Subject of the Reclamation of the Overflowed Lands of the San Joaquin Valley, September 20, 1879 (San Jose: McNeill Bros., 1879), p. 9.

necessitated a great deal of bulk in the initial structure.¹⁸ How widespread this practice was elsewhere could not be determined from preserved accounts.

Dams were always furnished with sluiceways and gates; the drainage capacities of the installations were commensurate to the area served. The facilities also served as controls of irrigation water.¹⁹ Twelvemile Slough was pierced by four timbered sluiceways, each of which had a pair of bolted double-plank tide gates.²⁰ Redwood was the preferred material at first, but after 1885 wood began to be replaced by more durable flanged tubes of boiler iron. Cast-iron tide gates probably came into wider use about this time. To reduce the seepage hazard along the outer line of the conduits, clay was packed in closely around them prior to placing the remainder of the fill.²¹

The Levees

Levee specifications varied according to site requirements and the resources and objectives of the builders. In

¹⁸"Reclamation of Tide Lands," SWI, Nov. 14, 1875, p. 5; "Reclaiming the Tide Lands," ibid., April 10, 1875, p. 5.

¹⁹"Reclamation of Swamp and Overflowed Lands in California," loc. cit.

²⁰The sluiceways and gates required 24,000 feet of lumber per unit and cost \$300 each. The whole dam cost \$3,200 to complete. It required 24 days for a gang of 78 Chinese laborers to do the work. "Reclaiming the Tide Lands," SWI, April 10, 1875, p. 5.

²¹"Reclamation of Marsh Lands in California," PRE, May 30, 1885, p. 510.

Removing the Tules

Burning was the accepted method of removing stands of tules. It was done in the fall, after the tops had died and when the sod was driest. Sometimes the standing tules were rolled or mowed before burning to insure more thorough destruction of the vegetation. At other times the standing cover was burned subsequent to the burning of the sod. Whatever the timing, the object was to remove an enormous bulk of matted material which hindered other steps in land preparation such as ditching or plowing.⁹

Breaking the Soil with Fire

Burning was also the cheapest and quickest method of reducing the fibrous organic soil to a workable condition. From the earliest times there was an awareness that the organic material lost about half of its original volume with burning, and that the surface of the land was lowered accordingly. Deeper burning was to be avoided.¹⁰ The depth of

⁹A representative roller, used on the Lisbon District, consisted of double cylinders mounted in a frame similar to that of a reaper. The diameter of the cylinders was about six feet. The equipment was mounted in front of the horses. "A Ride through Lisbon District," PRP, Jan. 19, 1878, p. 34. Rollers of ten feet diameter, pushed by four horses and steered into the tules by means of a rudder wheel are described also. Illustrations of Contra Costa Co., . . . p. 8; Tide Land Reclamation Co. (1869), op. cit., p. 39, citing SF Times, June 22, 1869; Munro-Fraser, History of Contra Costa County, . . . p. 54; Hoag, loc. cit., p. 341; "Our Reclaimed Tule Lands," PRP, April 3, 1875, p. 1; "A New Shipping Point," ENI, Aug. 24, 1878, p. 2; Nordhoff, op. cit., p. 130.

¹⁰Tide Land Reclamation Co. (1869), op. cit., p. 39.

fire penetration was controllable a little by using the tide gates to manage water levels in the tract or by postponing the burning until desiccation had taken place to a desired depth. There is no direct evidence that the water levels were controlled for this purpose in the early reclamation days. Rather, the depth of burn was controlled by the timing; early burns resulted in shallow penetration because dampness retarded the fire.¹¹ It seemed to be customary to let the turf dry enough to be burned 6 to 18 inches deep.¹² The thoroughness and penetration of fire was greatest in the peat areas, and it diminished as the mineral content of sod increased. On the upper portion of Roberts Island, for instance, some of the burning would reach into only the top six or seven inches of peaty material.¹³

The general practice was to ignite the sod in many places.¹⁴ One procedure was to have a Chinese laborer dig holes into the turf, followed by a second man who dropped wisps of straw into the holes and started the fires.¹⁵ A second method, devised by a farmer on Upper Roberts Island when he could not start fires otherwise, was to ignite

¹¹"Reclamation of Swamp and Overflowed Lands in California," Report of the /U.S./ Commissioner of Agriculture for the Year 1872, p. 185.

¹²Tide Land Reclamation Co. (1869), loc. cit.; Browne, loc. cit., p. 397.

¹³"Burning Tules," FRP, Nov. 16, 1878, p. 309.

¹⁴Tide Land Reclamation Co. (1869), loc. cit.

¹⁵Nordhoff, op. cit., pp. 130-31.

kerosene that had been poured into numerous depressions kicked into the turf.¹⁶ Willows and other undesirable woody growth were cut out of the ground after the fires.¹⁷

Ashes and the scorched alluvium that remained after the fire usually would not support horses or oxen.¹⁸ Even though walking on peat ash surfaces was disagreeable, sowing was done by hand, commonly with a coffee-mill sower.¹⁹ The broadcast seed was brushed in by dragging branches over the ashes,²⁰ or it was trampled in by slowly and systematically driving compact bands of sheep over the surface. Bands of 200, 300, and 500 sheep did thorough work. In districts where the mineral soil particles formed a large proportion of the volume of a soil, or where the peat was well dried out, plowing and harrowing preceded seeding and harrowing.²¹

While to burn and "sheep-in" land must have involved variable costs, records of the expenses entailed are sketchy. The following data may or may not have been representative. A tract of 1,500 acres was burned in 1871 or 1872 for \$100.²²

¹⁶"Burning Tules," FRP, Nov. 16, 1878, p. 309.

¹⁷San Joaquin County Board of Supervisors, San Joaquin County, California, for the Farmer, p. 51.

¹⁸Hoag, loc. cit., p. 343.

¹⁹Nordhoff, op. cit., p. 131. Seeding was done at a rate of 20 to 40 pounds per acre. "Our Reclaimed Tule Lands," FRP, April 3, 1875, p. 221.

²⁰Ibid.; Tide Land Reclamation Co. (1869). loc. cit.

²¹Hoag, loc. cit., p. 341; "Cultivation of the Tule Land," SWI, Jan. 18, 1879, p. 5.

²²Nordhoff, loc. cit.

To "sheep-in" cost from 35 cents to \$1.25 per acre.²³ A band of 500 sheep could cover about 10 to 16 acres per day, allowing time for feeding on the levees or on volunteer cover.²⁴ In later years, rolling, burning, and grubbing cost \$3.75 per acre, plowing \$5.00, and harrowing \$1.25.²⁵

The first grain crops averaged up to 40 and 60 bushels per acre, though not consistently. Harvesting with headers was accompanied by rather large grain losses. Sometimes sheep were permitted to glean and to tramp in seed for a volunteer second crop. At other times the second crop was encouraged by plowing with a two-share gang plow drawn by four horses wearing tule shoes.²⁶ By this time desiccation and oxidation had proceeded far enough that the organic soil would support the teams.

Economy was not the only reason that made the burning of tule turf attractive to farmers. It produced fairly good seedbeds. Also, it was believed that the fires prevented "disastrous miasma," and in so doing made the islands more habitable.²⁷ More important, the system often resulted in

²³Tide Land Reclamation Co. (1869), loc. cit.; "Reclamation of Swamp and Overflowed Lands in California," loc. cit.

²⁴Ibid.; Nordhoff, loc. cit.

²⁵San Joaquin County Board of Supervisors, loc. cit.

²⁶Nordhoff, loc. cit.; Hoag, loc. cit., p. 343.

²⁷"A Ride through the Tule Country," SWI, Sept. 1, 1877, p. 5; "Burning Tules," PRE, Nov. 15, 1876, p. 309.

spectacular yields which "contributed to keep up the delusion that such was a proper treatment of these lands."²⁸

The practice of burning peat had serious shortcomings. The fires were likely to penetrate irregularly, burning deep holes here and there; or to progress irregularly, leaving hummocks of unaltered living and dead organic material among the ashes.²⁹ The uneven surfaces that resulted hindered efficient operation of teams and equipment.³⁰ Lowered surfaces were harder and more expensive to keep drained.³¹ Soils were depleted, and mineral salts became concentrated in a narrower zone. The occasional escape of fire into peat levees threatened immediate disaster. The dense smoke and ashes that blew eastward caused discomfort in communities to leeward.³²

Breaking the Soil with the Plow

Virgin peat was difficult to plow before mechanically powered equipment came into use. When it was wet it was too

²⁸"Burning Tule Lands," ed. of SF Bulletin, Jan. 17, 1879, in BS, Set W 18:2, p. 317.

²⁹Nordhoff, op. cit., p. 130.

³⁰Browne, loc. cit.

³¹"Burning the Tule Lands," SF Bulletin, March 24, 1879, in BS, Set W 18:2, p. 317.

³²An interesting case of a fire escaping into the levee of Lower Roberts Island occurred in November of 1878. The fire was restricted to a 450-foot section by cutting trenches into the levee; it was put out by pouring on water for a day and a half. The water was pumped by a fire engine which had to be barged some 60 miles from Stockton to reach the fire. "The Roberts' Island Fire," SNI, Nov. 2, 1878, p. 7.

By the 1870's farming was flourishing. The delta's early vegetables earned premium prices in central California cities, while the staple potatoes and beans comprised a large share of the state's produce.¹ Livestock, dairy products, and hay were shipped to San Francisco Bay cities, as were also deciduous fruits, chiefly peaches and pears. Moreover, the premium fruit found ready markets in the East once trans-continental rail shipments were feasible. Wheat, California's second golden harvest, was produced in the delta for export.

Some irrigating had been done earlier, but the practice does not appear to have become a common part of delta farming until the 1870's. Flood irrigation had been tried on small grain by 1871, but was given up because of the excessive weed growth that resulted.² For other crops land soaking before planting or flood irrigation were practices in use during the 1870's. Subirrigation prior to plowing and planting dates from the same decade; it was originally used for beans and potatoes or to encourage the growth of a volunteer hay crop.³ Since then subirrigation has been used on all growing crops.

¹In 1875 nearly all of the delta produce trade was with San Francisco. "Down the River," Sacramento Bee, Nov. 5, 1875, in RS, Set W 5, "California Counties; Santa Cruz to Yuba," p. 1870.

²"Sherman Island Improvements," MSP, May 22, 1869, p. 330.

³"Crops on Sherman Island," correspondence to SF Bulletin, May 21, 1871, in RS, Set W 18:1, p. 147; "The Tule

Irrigation water was delivered to the backswamp land through tidal gates and drainage ditches in the 1870's. Filled mains backed water into field ditches of two- to four-foot depth; from these the water spread along the six-inch- to two-foot-deep laterals ("spud ditches") which were spaced at intervals of 65 to 85 feet. Seepage occurred in the peat soils. Water levels were controlled with dams across the ditches.⁴

Water delivery systems independent of drainage ditches were in use by the latter 1870's.⁵ These systems were maintained by the farmer, only the drainage system being the responsibility of the reclamation districts. Water wheels, windmills, and low-head pumps were used on the higher alluvial banks⁶ where furrow and check irrigation were the rule. Gravity flow and siphons after the 1900's were used on the lower tracts.⁷ Nevertheless, it appears that much of the

Lands of the San Joaquin," SF Bulletin, March 24, 1879, in ES, Set W 18:2, p. 336; "Reclamation of Swamp and Overflowed Lands in California," Report of the U.S. Commissioner of Agriculture for the Year 1872, p. 186; "Agricultural Notes--Contra Costa," PRF, April 5, 1879, p. 228.

⁴Letter of H. Eugene H. to ed., FRP, Feb. 11, 1878, in BLS, No. 21, p. 274; Report of the Conservation Commission of the State of California, January 1, 1913, p. 222.

⁵"Tule Farming," SWI, March 31, 1877, p. 7.

⁶McKeag, "Delta Report," Unit 3.

⁷"How Rich Land Is Saved from California Rivers," FRP, July 1, 1905, p. 5; Wells, "Tilling the 'Tules' of California," loc. cit., p. 314; idem., "San Joaquin County, California," loc. cit., p. 695.

land was without irrigation as late as 1898, when, to save grain crops, the Moss Tract levee was breached to admit water, and a steamer was used to pump water onto Rough and Ready Island.⁸

Agriculture, 1900-1924

Although it began earlier, the transformation of delta farming of perishable crops from garden to field agriculture is essentially a twentieth century development. Asparagus, celery, and tomatoes were handled thereafter on a scale previously associated only with such hardy staples as potatoes, beans, and onions. Sugar beets developed into an important cash crop. The scale of all operations expanded rapidly. Barley replaced wheat as the major winter grain crop. Dairying grew apace in the San Joaquin delta. To the north, along the natural levees of the Sacramento, Bartlett pear orchards reached their prime. Alfalfa hay was cut for the city livery trade or, along with crop waste and other feed, was moved to market in the form of beef and mutton.

Marketing methods altered around 1900. Canneries and wholesale produce houses began to handle delta crops directly; trade names and product standards were adopted; and buyers went into the field to contract for crops. Earlier the

⁸Cosby, "Delta History Notes," pp. 18-19; SWI, March 25, 1898; *ibid.*, April 9, 1898. In 1909 less than half of the reclaimed land was irrigable. Report of the Conservation Commission of the State of California, January 1, 1913, pp. 165, 222-23.

west of Stockton, and supported truck gardens along the San Joaquin.²⁵

An idea of the nature of small-scale farming in the 1870's is afforded by glimpses of activity at Rough and Ready, Roberts, and Sherman islands. On Rough and Ready Island a handful of Italian share tenants and hired hands worked several properties, raising tomatoes, peppers, egg-plants, a little asparagus, and other truck crops. Some 12 acres of deciduous orchard and vine and a few acres of alfalfa were farmed at the eastern end of the island. At times the orchard owner and largest operator was able to ship \$1,000 worth of produce per week to San Francisco and Stockton.²⁶ By early 1879 the island was shared with cultivators who raised field crops of barley, potatoes, corn, and beans on the lower back-slopes and in the reclaimed back-swamps. The relationship of truck gardens to island peripheries and of field agriculture to the lower land was established early.²⁷

The conversion of natural levees into farm land on Roberts Island may be credited to Chinese lessees who, at

²⁵"San Joaquin News," SF Alta, June 10 and 13, 1852, in ES, Set W 4, p. 1397; "San Joaquin News," SF Alta, Sept. 26, 1852, in ES, Set W 4, p. 1406; Report of the Commissioner of Public Works /1894/, p. 14.

²⁶"Tule Farming," SWI, March 3, 1877, p. 7.

²⁷"Agricultural Notes--San Joaquin County," FRP, April 26, 1879, p. 277; "Down Among the Tules," SF Bulletin, Feb. 23, 1880, in ES, Set W 4, pp. 1510-11.

least by 1869, were establishing truck and fruit gardens on the San Joaquin River side of Roberts Island.²⁸ South of Rough and Ready Island the cleared land had become an almost continuous series of 6- to 50-acre cultivated plots by 1875. The farmed strip stretched into the island 200 to 500 feet. Another 60-acre strip of cultivated levee was located on the west side of the island to the north of the Pescadero Grant line. Here and there along the levee were the homes and barns of a dozen white families, chiefly grain and bean farmers and stock owners.²⁹ Scattered clusters of Chinese gardeners occupied the Grant land. Like the renters to the north, the Chinese raised onions, beans, and blackberries.³⁰

Once the land development companies began to reclaim the backswamps in the 1870's, the land use pattern changed. Extensive grain fields appeared over the interior of Roberts Island.³¹ The white lessees were mainland residents as well as island settlers. Most of the latter lived within a mile of the river; their houses occupied slight alluvial prominences amidst the grain fields. Some of their farm structures had been built by the land developers as base camps for

²⁸"Notes of a Trip Up the San Joaquin River," letter to ed., SWI, June 19, 1869, p. 5.

²⁹One farm, described in 1877, consisted of 170 acres, of which 60 were wheat, 10 barley, and 10 beans. The rest was tule, useful for pasture. "A Tule Land Farm," SWI, March 24, 1877, p. 7.

³⁰"Among the Tules," SWI, Oct. 7, 1876, p. 5.

³¹"Down among the Tules," SP Bulletin, Feb. 23, 1880, in ES, Set W 4, p. 1511; "Agricultural Selections," SP Bulletin, Aug. 26, 1878, in ES, Set W 18:2, p. 295.

the reclamation and land clearing crews.³² In addition to the expansion of grain fields over the interior of the island, an enlargement of bean and potato acreage occurred near the river, where the thrifty Chinese and Italians even planted on the artificial levee.³³ A few small deciduous orchards were scattered around the higher periphery too.³⁴

Sherman Island developed an agricultural landscape similar to the one at Roberts Island. In the years when the island remained dry, wheat and barley acreage was extensive; there were about 4,150 acres of small grain in 1871,³⁵ 7,000 acres in 1873/74,³⁶ and 10,000 acres in 1874/75 (flooded).³⁷ As a rule, the wheat and barley were planted on high-water-table virgin or young soil while the rented produce land was located near the river. Chinese farmers raised potatoes,

³²"Gigantic Enterprise," *SMI*, Sept. 25, 1875, p. 4; "A Ride through the Tule Country," *ibid.*, Sept. 1, 1877, p. 5.

³³"Through San Joaquin County," *SF Bulletin*, March 22, 1879, in *BS*, Set W 4, p. 1502.

³⁴"Supplemental Report on the Condition of Various Fruit Districts," Third Biennial Report of the State Board of Horticulture of the State of California for the Thirty-eighth and Thirty-ninth Fiscal Years (Sacramento: 1888), p. 261.

³⁵This writer's estimate is based on a reported 100,000-sack crop for the 1870/71 season. "A Tour through the Interior," *SF Alta*, Sept. 23, 1872, in *BS*, Set W 18:1, pp. 154-55.

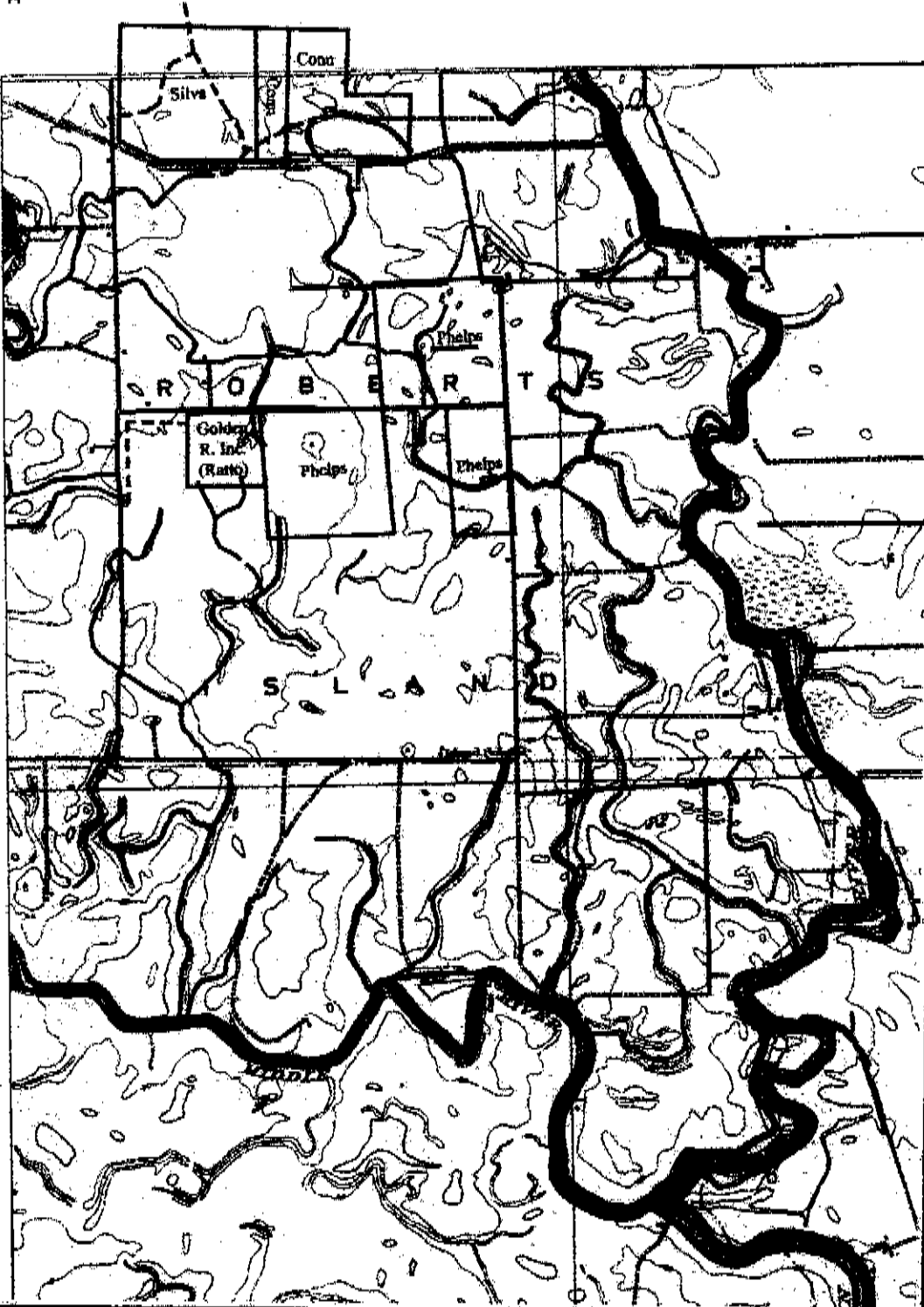
³⁶"Sherman Island," letter to ed., *SF Alta*, Aug. 10, 1874, in *BS*, Set W 18:1, p. 162; Nordhoff, *op. cit.*, p. 132; address of J. A. Hoamer, San Joaquin Valley District Agricultural Society, "Transactions," in *Calif. State Agric. Soc., Transactions During the Year 1874*, p. 620.

³⁷"The Flood at Sherman Island," *SMI*, Jan. 30, 1875, p. 5.

EXHIBIT D

Note: Features of this drawing originated with an outside source.

Source Used
 (1) NCIC 1912 Topography Map #038-508
 (2) S.J.C.R. Plat. 31 - Page 31



<p>1912 USGS TOPOGRAPHY MAP PARCEL LINES AND WATERCOURSES UPPER ROBERTS ISLAND</p>		<p>K. KJELSEN S. SINNOCK N. NEUDECK</p>	<table border="1"> <tr> <th>Sheet No.</th> <th>Date</th> <th>By</th> <th>Scale</th> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>	Sheet No.	Date	By	Scale												
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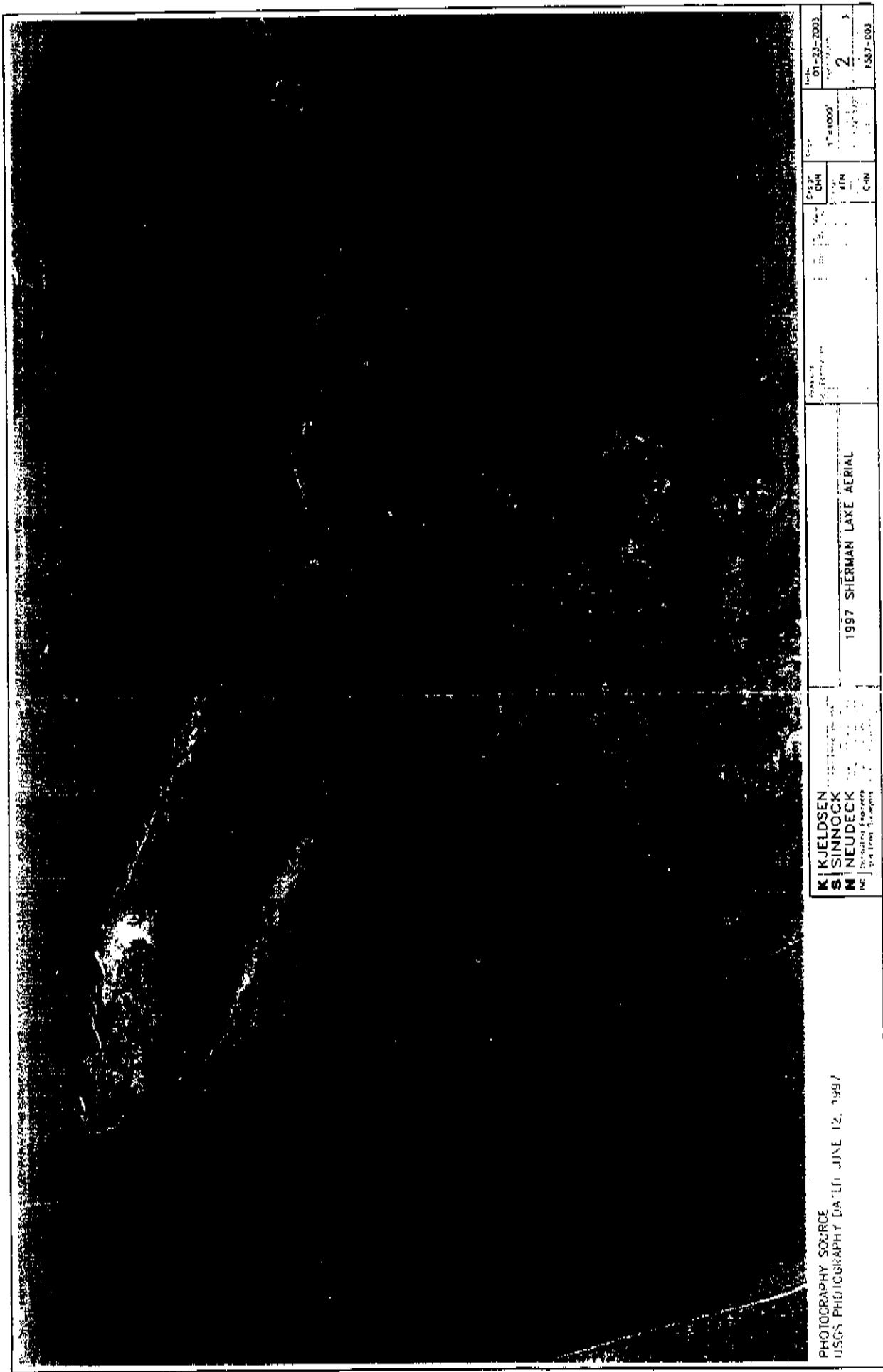


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 For 1981-1997

1997 SHERMAN LAKE AERIAL

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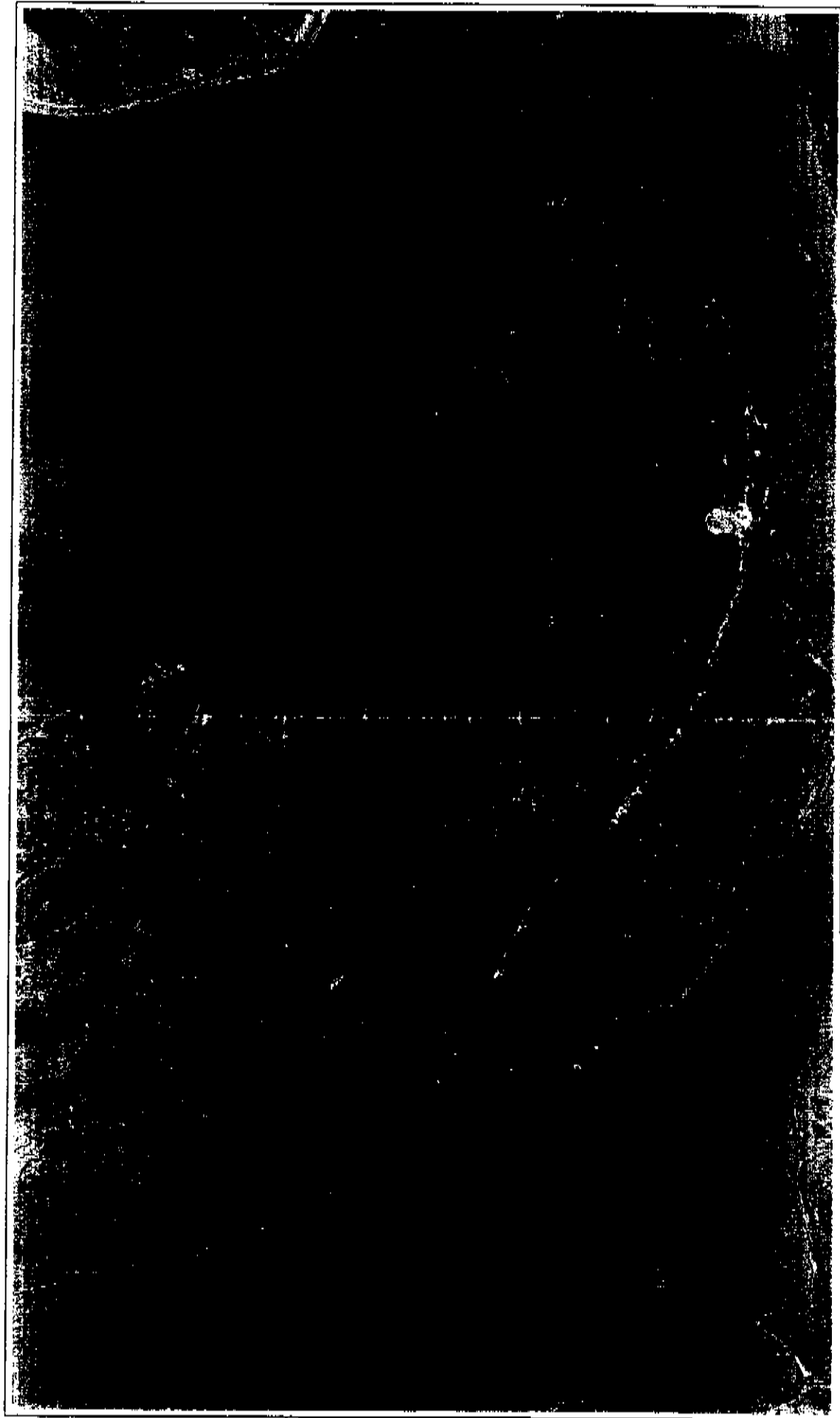
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DAILY EVENING HERALD

CITY OFFICIAL PAPER.

MONDAY EVENING, MAY 12, 1879

LOCAL MATTERS.

NOTARY PUBLIC.—Governor Irwin on Saturday commissioned H. T. Compton a Notary Public, for San Joaquin county, to reside at Stockton.

THE FIRST PARTY.—Mr. A. M. Rowe took out the first party of tourists for Yo Semite to-day. The party consisted of nine ladies from Oakland.

REHEARSAL.—Prof. Jackson wishes us to state that he will give his second Pinafore rehearsal this evening, and requests all who wish to take part in this Opera, the production of which he promises to give to the public in a short time, to be present to-night without fail.

AUCTION.—Geo. W. Melone will commence selling out at auction the stock of dry and fancy goods to-morrow afternoon at 2 o'clock, at the late firm of G. H. Fairbrother, Yo Semite Block. All persons wishing to get goods at their own prices, will do well to attend.

BURGLARIES.—The saloon of Hargrave & Smith, in the Yo Semite block, was burglarized Saturday night. A watch and a small amount of silver were obtained. Last night the shop of M. McCormick, on Main street, was entered and several pairs of boots stolen.

SCOTCH HEATHER.—Chief Joseph Fyfe, of the Caledonian Club, has placed upon a table a sprig of "Highland heather," received by him from his father-in-law, Bruce, Esq., Scotland.

The heather queen o' mountain flow'r
Wha e'er saw sic anither?
Search round the world it dings them a'
There's naicht like "Highland heather."

POLICE COURT.—In the Police Court to-day, J. J. McCullough, was fined \$5 for being drunk. J. C. Hays, charged with assault, was arraigned, and his case set for trial May 15th, at 10 o'clock. He gave bail in the sum of \$50. Harry Lane, charged with an assault with a deadly weapon, was arraigned, and his preliminary examination set for May 13th, at 11 o'clock. Jack Mullin, charged with battery, pleaded not guilty; his trial

A Trip to Roberts Island.

Having heard many reports of the damage done upon Roberts Island by the heavy frosts which visited that section last week, upon the invitation of a friend we accompanied him upon a tour of inspection to the Island. Leaving Stockton we took the French Camp Gravel Road crossing the river at Lindstrom's Ferry, first visiting the land which is being cultivated by John Grattan. He has 500 acres of barley which is very fine and was damaged but little by the frost. He also had planted eleven acres of potatoes which, until the frost came, gave every appearance of giving a good yield, but now there is not a hill left, all having been killed. After leaving this ranch we passed on down the river to the ranch of Joseph Hale. Here the effects of the frost were much plainer to be seen. He had one hundred and twenty acres of land planted in vegetables of different kinds, and as his land is all in a high state of cultivation, his prospects for an immense growth were all that could have been desired. The ranch presents a different appearance now. There is nothing left standing except a few acres of onions, which the frost did not damage, and some sweet potatoe plants, the most of which however have been set out since the frost. Mr. Hale informed us that he has sent to San Francisco for seed, and as soon as it arrives he will replant his ground, and as he has facilities for irrigating his land, thinks he can raise another crop this season. Leaving this ranch we passed on down the river to the land which is being cultivated by Mr. J. M. Garwood. Here the frost appears to have been more severe than in any other locality on the Island. It made a clean sweep of everything that had been planted. Although this is, we believe, the first crop that has been planted upon this section of the Island, it gave every appearance, until the frost, of making an immense yield. It is his intention, we are informed, to commence to-day and cut his entire crop of grain while it yet remains green, and save it for hay. This blow falls quite heavily upon Mr. Garwood as he has been particularly unfortunate for the past few years. Wishin' to visit the other portion of the

Ratification.

The supporters of the new Constitution held a ratification meeting on Hunter street square Saturday evening, which was one of the largest, if not the largest meeting of the season. Bonfires and music were provided in abundance. Dr. C. Grattan presided, and introduced as the first speaker, Judge D. S. Terry. The following are extracts from his speech: "This is the first victory the people of California have won over the corporations, rings and money power. I am proud of the victory, proud of the country, and prouder of the men who have won the victory. The enemies of the Constitution claimed that there was arrayed against its adoption all the wealth, all the respectability and intelligence of the State, I grant that they had all the wealth, but deny that they had all the intelligence. The producers, the men on whose success the prosperity of the country depends, the men who could neither be intimidated nor bribed, the intelligent farmers and mechanics, who perform all the duties of good citizens, and who pay their taxes for the support of the Government, were all in favor of its adoption. Every man who could be intimidated or bribed voted against you. The Constitution was carried by honest and intelligent men—brave men, who knew their rights, and knowing, maintained them. While you have achieved this glorious victory, all is not done. In order to enjoy the fruits of this great triumph there is yet work for you to do. The Constitution must not be trusted to the hands of its enemies. This duty was clearly and forcibly expressed by one of your Supervisors, Uncle Billy Fairchild, yesterday. He said: "After we have built a ship and launched it, and equipped it, and provisioned it for a successful voyage, we would be d-d fools to put a crew of pirates on board." (Cheers.) Are you going to do it? (Shouts, "No!") Two of the corporation organs to-day say that by combining all the respectable of both political parties,—(all the men who have got money and are respectable, whether they stole it or not),—they can carry the next election. The provisions of the laws to be enacted to put them in force,

EXHIBIT F

15th, at 11 o'clock. Jack Mullin, charged with battery, pleaded not guilty; his trial was set for May 15th, at 10 o'clock.

SHIPMENTS.—Sperry & Co. shipped 5,000 quarters of flour; J. W. Smith 9 bales of wool; J. D. Peters 43 bales of wool; Ah Ling 16 barrels of dried fish; John Moore 2 Jersey bulls; Pacific Tannery a lot of hides and glue stock, by the steamer Mary Garratt. J. W. Smith 40 bales of wool; J. D. Peters 50 tons of yarn; Woolen Mills 3 cases of woolen goods; Rosenblum & Co. 3 cases of merchandise; Ah Ling 37 sacks of potatoes; Donnelly Dunn & Co. 300 head of sheep, by the steamer Pride of the River.

THE PACIFIC TURN-BEZIRK.—The turners of this city are making careful and elaborate preparations for the Grand annual Festival of the Pacific Turn-bezirk which will be held in this city the second week in June. The Railroad company have made special rates from the principal cities to and from Stockton, and will issue tickets at half the usual rates. These tickets will be good for five days. The programme of exercises, which will continue three days, is laid in another column, and especial attention is directed to it.

WHEAT.—The wheat receipts at the Centre street depot to-day consist of 15 cars consigned as follows: Farmers' Union 1, J. W. Smith 4, J. E. Harrison 1, R. Lane 1, J. W. Smith, shipped 10 cars; J. D. Peters 305 tons by the steamer Mary Garratt. Gawne & Co. shipped 1,948 sacks of wheat; L. S. Boston 1,055 sacks of wheat by the steamer Clara arrived from Hills Ferry with 630 tons of wheat and 85 bales of wool, consigned to Capt. L. D. Hamilton. Wheat quoted at \$1.55 to \$1.60. A very large lot was purchased to-day at \$24.

PROFESSOR TAYLOR.—Professor E. C. Taylor will close his series of entertainments at the theatre this evening. His talents have been well appreciated, combining the counter attractions in the form of political meetings and the lectures of the Institute, and his engagements are profitable to himself as well as satisfactory to those who attend his entertainments. This evening he will introduce the eye dance and the trial of the one performance, in which Mills is assisted. This evening \$35 in coin.

Garwood as he has been particularly unfortunate for the past few years. Wishing to visit the upper portion of the Island before our return home, we extended our investigations no further down the Island, but returned to Lindstrom's ferry, and then left for the upper part of the Island. The section above the ferry does not appear to have suffered much from the frost as we did not observe its effects except in a few places where the ground was low. Messrs. Lemon & Wing and Mr. Samuel Peters, each have in twelve hundred and forty acres of grain, nearly all of which will make a good yield. Mr. J. Mills has fifteen hundred acres, which we were informed has been somewhat damaged by the late dry winds. Passing on up the Island we visited some portions of what is known as Naglee & McLaughlin's reclamation. Messrs. Matthews & Lowry, who own a portion of this section of the Island, have placed a flume through the levee with the intention of establishing a thorough system of irrigation on their land, if they are successful in making this flume, which is quite a large one, capable of carrying several thousand inches of water, work. One of the gentlemen informed us that although several experiments of this character had been attempted, none of them have been satisfactory, as the water works in around them, and in a short time the ground becomes saturated and it breaks through the levee, doing more or less damage. In the present instance the parties feel sanguine of success, as they have taken great pains in doing the work, building the flume out of heavy lumber and tamping the ground in around it in the most thorough manner. Should this experiment prove successful there is no doubt but that a great many others will follow their example, as they will be thus enabled to raise as many crops during the season as will mature, the ground being very rich everything grows unusually fast. The Grant Brothers have twenty-five acres planted in potatoes upon land which was cleared of willows last year, that are as fine looking as one would wish to see. They expect them to yield at least eighty sacks to the acre, and the indications are that they will go much beyond that figure. Returning down the Island we re-crossed the river at Charles Frawert's Ferry and took the road to Mr. Jacob Miver's ranch. This is the

the next Legislature; and then, as the provisions of this Constitution require laws to be enacted to put them in force, the Legislature can enforce such provisions as are not objectionable and leave the objectionable dead letters. The objectionable features to them are those which provide for the equality of taxation—that require every man in the State to contribute to the support of the Government in proportion to the property he possesses—and those which are intended to prevent extortion by railroad and other corporations. These very objectionable provisions are the ones which the people are determined shall be enforced. Steps have been taken here and in San Francisco, Sacramento and elsewhere, to organize a Constitutional party, composed of the friends and supporters of this instrument. This is a matter for you to consider and to speak about with your neighbors. This county has done its full duty, notwithstanding all the intimidation and bribery that was practiced. You see to it that men are elected to the Legislature who will enact such laws as are necessary to carry out the provisions of this instrument in the spirit in which they were framed and adopted by the people. I advise you to take counsel with each other and adopt such measures as will secure you the benefit of the provisions of the Constitution which you adopted. This can only be done by selecting honest, intelligent men to represent you in the Legislature and to fill the various offices created under this Constitution. See that the good ship which you have built and launched and equipped for the purpose of suppressing the piracy and robbery is not manned by a crew of pirates. Place in charge of her honest and competent men, who will conduct her safely on her voyage, and your State will enter on an era of unexampled prosperity. Neither of the political parties which have alternately administered the government of the State is to be trusted under its present leaders. The railroad company has managed to control the conventions of each party and to procure the nomination of men for Governor, who suited their purpose, so that, no matter whether Republicans or Democrats were elected, they had friends in the Executive chair. They have corrupted the Legislature, and have by bribery or other means prevented the passage of any act to regulate freight and fares, and the man who mainly contributed to this result has been elected to the United States Senate. The Governor of your State left his post at the Capital and took the stump in opposition to the adoption of the Constitution at the beck of the railroad company. What inducements did he receive from his own county, where he is best known, and where he should exercise the most influence? The people of Siskiyou voted over three to one for the adoption of this Constitution. Our only safety is in elect-

...the wheat receipts at the entire street, depot to-day consist of 15 as consigned as follows; Farmers' Union W. Smith 4; F. F. Harrison 1; R. Lane 1, J. W. Smith, shipped 10 as; J. D. Peters 300 tons by the steamer Mary Garratt. Gawne & Co., shipped 1,048 sacks of wheat; I. S. Boston 1,055 sacks of wheat by the steamer side of the River. The steamer Clara arrived from Hills Ferry with 638 sacks of wheat and 85 bales of wool, consigned to Capt. L. D. Hamilton. Wheat quoted at \$1.55 to \$1.60. A very nice lot was purchased to-day at 62.

PROFESSOR TAYLOR.—Professor E. C. Taylor will close his series of entertainments at the theatre this evening. His efforts have been well appreciated, comparing the counter attractions in the form of political meetings and the others Institute, and his engagement has been profitable to himself as well as satisfactory to those who attend his entertainments. This evening he will include the egg dance and the serial exhibition performance, in which Mile. Lor assists. This evening \$35 in coin, leading prize, and one hundred other prizes will be drawn by the audience. This evening is Professor Taylor's last performance.

County Official Return.
The Board of Supervisors canvassed the returns for the Constitutional election on the 7th inst. The following is a detailed statement of the vote as officially announced, showing the majority in several precincts and the majority for of the new Constitution:

Precinct	For	Against	Total
1st Ward	250	297	547
2nd Ward	373	451	824
3rd Ward	341	302	643
4th Ward	47	47	94
5th Ward	129	28	157
6th Ward	120	48	168
7th Ward	61	8	69
8th Ward	187	96	283
9th Ward	64	21	85
10th Ward	57	26	83
11th Ward	110	67	177
12th Ward	48	40	88
13th Ward	27	19	46
14th Ward	136	98	234
15th Ward	90	62	152
16th Ward	19	4	23
17th Ward	64	3	67
18th Ward	28	28	56
19th Ward	42	21	63
20th Ward	31	25	56
21st Ward	118	22	140
22nd Ward	63	28	91
23rd Ward	4	12	16
24th Ward	2	1	3
25th Ward	21	14	35
26th Ward	55	19	74
27th Ward	37	37	74
28th Ward	112	112	224
Total	3750	3750	7500

character had been attempted, none of them have been satisfactory, as the water works in around them, and in a short time the ground becomes saturated and it breaks through the levees, doing more or less damage. In the present instance the parties feel sanguine of success, as they have taken great pains in doing the work, building the flume out of heavy lumber, and tamping the ground in around it in the most thorough manner. Should this experiment prove successful there is no doubt but that a great many others will follow their example, as they will be thus enabled to raise as many crops during the season as will mature; the ground being very rich everything grows unusually fast. The Grant Brothers have twenty-five acres planted in potatoes upon land which was cleared of willows last year, that are as fine looking as one would wish to see. They expect them to yield at least eighty sacks to the acre, and the indications are that they will go much beyond that figure. Returning down the Island we re-crossed the river at Charles Frewert's Ferry and took the road to Mr. Jacob Myer's ranch. This is the place where the celebrated star brand of butter is made; and a visit to it will repay anyone. Mr. Meyers has all the modern appliances for the manufacture of first-class butter. His cows are all first-class, while he has abundance of splendid land upon which to pasture them. His barns, cattle-sheds, etc., are built after the most approved patterns. In fact everything about his place indicates that he is thoroughly competent to make a success out of this business of which he is already assured. His butter is all purchased by the firm of Southworth & Grattan of this city, who find no trouble in disposing of every pound of it, at the very highest market price. After our visit to the last named ranch, it being late, we returned to the city.

Must be Sold!
One of the Finest Stocks of Dress Goods, Fancy Goods, etc., ever brought to Stockton will be sold for the next 30 days, regardless of cost. Cash, 25 cents per sheet; 20 yards best American Flannel, \$1; 15 yards heavy Canton Flannel, \$1; 10 yards Dress Goods, \$1; and all other goods in same proportion. No. 181 El Dorado street.
Sewing Machine Needles, 25 cents per dozen at 181 El Dorado street.

men to represent you in the Legislature and to fill the various offices created under this Constitution. See that the good ship which you have built and launched and equipped for the purpose of suppressing the piracy and robbery is not manned by a crew of pirates. Place in charge of her honest and competent men, who will conduct her safely on her voyage, and your State will enter on an era of unexampled prosperity. Neither of the political parties which have alternately administered the government of the State is to be trusted under its present leaders. The railroad company has managed to control the conventions of each party and to procure the nomination of men for Governor, who suited their purpose, so that, no matter whether Republicans or Democrats were elected, they had friends in the Executive chair. They have corrupted the Legislature, and have by bribery or other means prevented the passage of any act to regulate freights and fares, and the man who mainly contributed to this result has been elected to the United States Senate. The Governor of your State left his post at the Capital and took the stump in opposition to the adoption of the Constitution at the beck of the railroad company. What indorsement did he receive from his own county, where he is best known, and where he should exercise the most influence? The people of Siskiyou voted over three to one for the adoption of this Constitution. Our only safety is in electing legislators who will enact such laws as are necessary to carry out the provisions of this Constitution, and an Executive who will see that those laws are enforced. See to it that this is done and the full fruits of this glorious victory assured to you and to your posterity.

Judge Terry was followed by L. W. Elliott, Esq., J. A. Louttit, Esq., O. J. Curtis, Esq., and others, all of whom made speeches which had the effect of bringing forth shouts of applause. The meeting was enthusiastic and orderly.

REWARD.—The Joint Committee on Fire Alarm Telegraph, consisting offer a reward of \$150 for the arrest and conviction of any person detected in meddling with the working of their telegraph lines.

"Where a woman," says Mrs. Partington, "has been married with a concealing heart, and one that beats depending to her own, she will never enter the marriage state again."

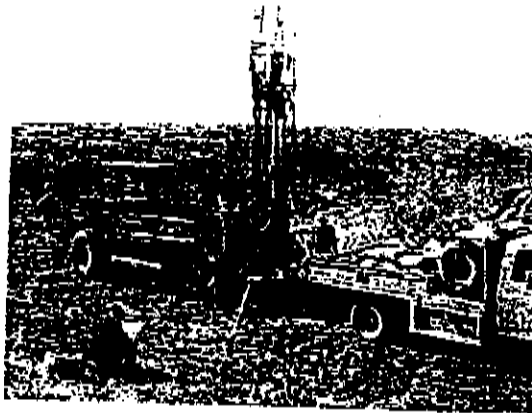
If the London Daily News correspondent is to be credited, Cyprus is in a pitiable plight. "The peasants," he says, "have begun to eat the malicious dog root in lieu of bread."

New Hampshire has shown her energy on the temperance question, but if she doesn't intervene to squelch this walking nuisance, she isn't the lady we took her to be.

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State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
Division of Planning and Local Assistance
Central District

**Reclamation District 544
Seepage Monitoring Study
2000-2001**




Memorandum Report

July 2001

Memorandum

Date : JUL 11 2001

To : Mike Ford
Office of State Water Project Planning

From : 
Karl P. Winkler, Chief
Central District
Department of Water Resources

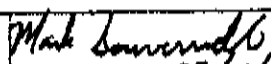
Subject: Reclamation District 544 Seepage Monitoring Study

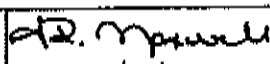
Central District is pleased to present the attached report, *Reclamation District 544 Seepage Monitoring Study, 2000-2001*. This report presents seepage monitoring results from Upper Roberts Island. Surface and groundwater level monitoring was initiated in April 2000 to evaluate the effects of the operation of the temporary fish barrier at the head of Old River on shallow groundwater levels on Upper Roberts Island. This work was completed at the request of the Temporary Barriers Project and Land Management Section of the Office of State Water Project Planning with the cooperation of Reclamation District (RD) 544 and several landowners.


Data was collected from seven groundwater monitoring stations and a river stage gage along the San Joaquin River at Upper Roberts Island. During the study period, river stage and groundwater levels did not rise above the Island's land surface and seepage was not observed.

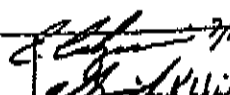
If you have any questions regarding this report, please contact Mark Souverville at (916) 227-7601.

Attachment


07/11/01


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Reclamation District 544 Seepage Monitoring Study 2000-2001

This report presents seepage monitoring results from Upper Roberts Island. Surface and groundwater level monitoring was initiated in April 2000 to evaluate the effects of the operation of the temporary fish barrier at the head of Old River on shallow groundwater levels on Upper Roberts Island. This work was completed at the request of the Temporary Barriers Project and Land Management Section of the Office of State Water Project Planning with the cooperation of Reclamation District (RD) 544 and several landowners.

Introduction

Upper Roberts Island is an agricultural area in the south Delta, bounded on the west by Middle River, on the south by Old River and on the east by the San Joaquin River. The north end of the head of Old River barrier rests on the Island's Old River levee at the point where it branches from the San Joaquin River. The head of Old River barrier is operated to benefit fisheries. Studies conducted by the U.S. Fish and Wildlife Service suggest that there may be a higher rate of survival for salmon smolt emigrating through the San Joaquin River rather than Old River (DWR 1998, 1999). The barrier is emplaced to prevent outmigrating salmonids in the San Joaquin River from entering Old River and subsequently the Central Valley and State Water Project pumps. It is constructed in the spring and fall of each year, except during high flows.

Streamflow and stage on the east and west sides of Upper Roberts Island is affected by the barrier. During periods of barrier operation, flow and stage in Old River are reduced while flow and stage along the San Joaquin River are increased.

Landowners on Upper Roberts Island have been concerned that the rise in San Joaquin River stage due to the fish barrier has caused a rise in the groundwater levels on the Island, creating a negative impact on crop production. The fish barrier at the head of Old River is bounded on both ends by private land, and temporary entry permits are required to install the barrier. The landowners on Upper Roberts Island have requested, as a condition of the temporary entry permits, that the Department of Water Resources (DWR) monitor groundwater levels on the Island to evaluate seepage

Monitoring Site Selection

Three seepage monitoring sites were chosen on Upper Roberts Island in coordination with Jerry Robinson, President of RD 544, Bill Darsie of Kjeldsen, Sinnock and Neudeck, and staff from DWR's Office of State Water Project Planning (OSWPP) and Central District (CD). A regional map (Figure 1) shows the location of the three monitoring sites, the San Joaquin River stage gages, and the head of Old River barrier. Well locations at each site were determined after evaluating boring samples and nearby surface features, such as canals. These locations are shown on topographic maps of the three sites (Figures 2-4). Each site has two shallow wells,

one near the levee toe and the other approximately 150 feet inland from the toe, to monitor the groundwater gradients adjacent to the San Joaquin River. An additional deeper well was drilled at Site 1 to attempt to determine the vertical gradient.

Monitoring Network Installation

Seven wells were installed prior to the spring 2000 emplacement of the head of Old River barrier. The well depths range from 18 to 40 feet below the ground surface with each well having a 5-foot screened interval. The goal was to install the wells within a saturated, coarse-grained unit beneath each site. A truck-mounted Central Mine Equipment 750 drill rig was used to drill the borings. All borings were advanced with 8-inch diameter hollow stem augers. Soils were collected for description using a continuous sampling tube. Details of the drilling, descriptions of the soils, and field classifications of the soils are provided on the drill hole logs in Appendix A. The construction details of each monitoring well are included with each well log. Table 1 lists the depth, reference point elevation, and screened interval for each well.

Well	Boring Depth ¹	Well Depth ¹	Screened Interval ¹	Reference Point Elevation ²
UR1A	30	28	23-28	16.15
UR1B	27	25	20-25	16.24
UR1C	40	40	35-40	16.01
UR2A	20	17	12-17	12.57
UR2B	21	19	14-19	12.21
UR3A	18	17	12-17	9.89
UR3B	20	20	15-20	9.92

1. Depth below ground surface in feet
 2. Reference point at top of plastic casing
 National Geodetic Vertical Datum 1929

Table 1. Well Depths and Reference Point Elevations

In addition to the groundwater monitoring well installations, a temporary tide gage was installed in April 2000. The gage was mounted on an existing pumping platform in the San Joaquin River about 1,500 feet downstream from the temporary barrier. A permanent station is planned to be constructed by fall 2001. The San Joaquin River stage is compared to groundwater levels on Upper Roberts Island to determine the effect of river stage on groundwater levels.

CD staff surveyed the monitoring network for elevation and horizontal position. The U.S. Army Corps of Engineers (USACE) and U.S. Geological Survey benchmark "Tidal 6," National Geodetic Vertical Datum 29, elevation 16.85 feet, is the datum for

this survey. The "Tidal 6" benchmark is located on the north levee of Old River near the temporary barrier. The elevation survey determined reference point and ground surface elevations at each monitoring well and a reference point elevation on the San Joaquin River tide gage.

Topographic maps of the seepage monitoring sites and adjacent river section, Figures 2 through 7, were constructed using data from USACE, Sacramento District. Ayres Associates, under contract to USACE, collected hydrographic and photogrammetric survey data of the San Joaquin River Basin in 1998. Along with geologic information from boring logs, USACE's data was used to develop cross sections perpendicular to the San Joaquin River at the seepage monitoring sites.

Well	Northing (Meters)	Easting (Meters)	Ground Surface Elevation (Feet)
UR1A	4186190	647406	13.06
UR1B	4186337	647391	13.04
UR1C	4186340	647390	13.01
UR2A	4190671	647506	9.38
UR2B	4190657	647460	8.96
UR3A	4191875	647681	6.67
UR3B	4191887	647639	7.24

CD staff determined geographic coordinates of the wells using a Trimble Pro XR Global Positioning System.

Universal Transverse Mercator Zone 10 projection

Table 2. Well Locations

Hydrogeology

The soils encountered at the three sites occur as alternating layers containing varying amounts of clay, silt and/or sand mixtures. Saturated coarse-grained layers were encountered at each site for placement of well screens. For a detailed description, refer to the drill hole logs in Appendix A.

At Site 1, as shown in Figure 5, alternating clay and silt layers were observed from the surface up to 24 feet below ground surface (bgs) during drilling. Total depth of borings for UR1A, UR1B and UR1C were 30 feet, 27 feet and 40 feet respectively. Water bearing sand occurs from 24 feet to the total depth of boring (TD) in UR1A, from 21 to 25 feet in UR1B, and from 20 to 24 feet and 29 feet to TD in UR1C. A clay layer occurs between two water bearing sand layers at depths of 25 feet to TD in UR1B and 24 to 29 feet in UR1C.

At Site 2, as shown in Figure 6, clay was observed from the surface up to 8 feet bgs. Total depth of borings for UR2A and UR2B were 20 feet and 21 feet respectively. Water-bearing sand occurs from 13 to 17 feet in UR2A, and from 15 feet to TD in UR2B. A clay layer occurs between two permeable sand layers at depths of 11 to 13 feet in UR2A and 14 to 15 feet in UR2B. Silt occurs from 17 feet to TD in UR2A.

At Site 3, as shown in Figure 7, alternating clay and silt layers were observed from the surface up to 11 feet bgs. Total depth of borings for UR3A and UR3B were 18 feet and 20 feet respectively. Permeable sand occurring from the surface to a depth of 6 feet in UR3A overlies silty clay that is present to a depth of 11 feet. Water-bearing sand occurs from 11 to 17 feet in UR3A and 10 to 13 feet and 16 feet to TD in UR3B. Clay occurs from 13 to 16 feet in UR3B.

Data from the geologic borings indicate that water bearing sand layers beneath each site likely extend to the left bank of the San Joaquin River (Figures 5 through 7). Groundwater should move freely within these sands, but the soils overlying these sands are primarily silts and clays, except at well UR3A. These silts and clays will impede the vertical movement of groundwater.

Monitoring Activities

The period of record for stage and groundwater elevation data in this report is April 20, 2000 to April 20, 2001. Groundwater elevation levels in each well are measured and recorded hourly using an In-situ Troll datalogger/transducer. The data is collected monthly with a palmtop computer. Stage data is measured and recorded hourly by a Hydrolab Datasonde 3. The data is collected monthly with a laptop computer. The San Joaquin River at Brandt Bridge station, maintained by DWR, measures and records stage data at 15-minute intervals. The river stage gage at Vernalis is operated jointly by the U.S. Geological Survey and DWR. It measures and records hourly stage data and posts it to the California Data Exchange Center web page.

Monitoring Results

The collected data were evaluated by creating hydrographs for each site showing groundwater elevation, ground surface elevation and San Joaquin River stage (Figures 8 through 15). Vertical lines bracket the periods of construction and removal of the head of Old River fish barrier. A solid horizontal line represents the ground surface at the monitoring site.

The following observations can be made from the San Joaquin River hydrograph, Figure 8. Over the period of record, water levels in the monitoring wells and the stage gage on the San Joaquin River at Upper Roberts Island peaked in April 2000, during a period of reservoir releases for the Vernalis Adaptive Management Plan (VAMP). Stage data from Vernalis, located 13 miles southeast and upstream of the barrier, show that the same activities (occurrences) that influence stage at

Vernalis are the primary influences on San Joaquin River stage along Upper Roberts Island.

The following observations can be made from the Site 1 hydrographs, Figures 9 through 13. Changes in groundwater elevation at the site mimic changes in the adjacent river stage but are less pronounced and lag slightly behind. The groundwater elevation in well UR1A was the most responsive to changes in river stage. During the period of record, the highest recorded river stage at the temporary gage on the San Joaquin River was 7.59 feet, coincident with a groundwater elevation of 6.38 feet (depth of 6.68 bgs) in well UR1A. During the period of record, the San Joaquin River maintained stage above groundwater from April 20, 2000 to mid May, the beginning of October to the beginning of December and mid February to mid March. During these periods, groundwater elevations in well UR1A were closer to river stage than to groundwater elevations in wells UR1B and UR1C. From mid May to mid August, the San Joaquin River maintained stage below groundwater elevations and groundwater elevations in well UR1A were predominantly below well UR1B. The elevation of groundwater in well UR1B is consistently slightly higher than in well UR1C, but the water level trends in the two wells are nearly identical. The predominant groundwater elevation gradient has been away from the San Joaquin River.

The following observations can be made from the Site 2 hydrograph, Figure 14. Changes in groundwater elevation at the site mimic changes in the river stage, downstream approximately 1.4 river miles at Brandt Bridge, but are less pronounced. The groundwater elevation in well UR2A was more responsive to changes in river stage than the groundwater elevation in well UR2B. During the period of record, the highest recorded San Joaquin River stage at Brandt Bridge was 5.51 feet, coincident with a groundwater elevation of 4.84 feet (depth of 4.54 bgs) in well UR2A. During the period of record, the San Joaquin River stage at Brandt Bridge was not observed above groundwater elevations in either well for any extended period. When stage did rise above groundwater elevation, however, the groundwater elevation in well UR2A approached river stage at a greater rate than the groundwater elevation in well UR2B. From April 20, 2000 to mid June, the San Joaquin River at Brandt Bridge maintained stage below groundwater elevations. During this period there were two events, at the end of May and beginning of June, when significant dips in stage were observed. As they occurred, the groundwater elevation in well UR2A shifted toward the river stage more than the groundwater elevation in well UR2B. The elevation of groundwater in well UR2B is consistently slightly higher than in well UR2A, and the water level trends in the two wells are nearly identical. The predominant groundwater elevation gradient has been towards the San Joaquin River.

The following observations can be made from the Site 3 hydrograph, Figure 15. Changes in groundwater elevation at the site mimic changes in the river stage at Brandt Bridge, which is just downstream of Site 3, but are less pronounced and lag slightly behind. The groundwater elevation in well UR3A was more responsive than the groundwater elevation in well UR3B to changes in river stage. During the period of record, the highest recorded San Joaquin River stage at Brandt

Bridge was 5.51 feet, coincident with a groundwater elevation of 3.69 feet (depth of 2.98 bgs) in well UR3A. During the period of record, the San Joaquin River stage at Brandt Bridge was above Site 3 groundwater elevations from mid June 2000 to the beginning of February 2001. During this time, groundwater elevations in the wells declined nearly 2 feet from June to mid August while the river stage maintained an elevation range of approximately 2 to 3 feet above sea level. The decline in well UR3B was also greater than well UR3A during this time. The elevation of groundwater in well UR3A is consistently higher than in well UR3B, and the water level trends in the two wells are nearly identical. In May 2000, an irrigation ditch, constructed nearly 50 feet from well UR3A and only 10 feet from well UR3B, was in use. Simultaneously, groundwater elevation levels in both wells rose sharply and, for a brief period, were greater in well UR3B than in well UR3A. The predominant groundwater elevation gradient is away from the San Joaquin River.

Summary

San Joaquin River stage elevation data and groundwater elevation data indicate that permeable strata underlying the Island are laterally continuous and are likely to be in contact with the riverbed. In general, groundwater in permeable strata such as these will fluctuate in response to changes in river stage. This relationship is seen in the hydrographs for each site (Figures 9, 14 and 15) where water levels in the wells respond to changes in river stage. When the stage increases in the San Joaquin River, the groundwater levels will rise towards the land surface, but not as rapidly as the river stage rises. Over the monitoring period, river stage has not reached a level sufficient to raise groundwater levels to the point where seepage may occur.

In some cases, the water levels in the wells may not accurately represent the water levels in the soils. The vertical movement of groundwater at these monitoring sites is likely to be inhibited by fine-grained sediments occurring above the saturated sand zones in which the well screens are completed. Therefore, rising water levels recorded in the wells are likely to be above the level of the surrounding water table. After a period of time, the water table may reach the water level in the well. The time necessary for this to occur is dependent upon the characteristics and distribution of soils that the groundwater must rise through.

A shallow permeable sand zone occurring at well UR3A is unique to the project. The vertical movement of groundwater at this location would not be restricted by overlying silts and clays, unlike other monitoring sites. If the sand layer is laterally continuous and in contact with the riverbed, groundwater at this well could respond quickly to rising river stage. Seepage may occur here soon after the river stage rises above the ground surface.

The stage and duration required for seepage to occur is dependent upon antecedent soil moisture conditions, topography, geology and soils, location and gradient of groundwater table, and local drainage works (DWR Bulletin 125, page 15). The lowest surface water stage necessary for seepage to occur at a particular site is called the critical base level (page 17). Once a site's critical base

level is reached, seepage may occur if the stage is maintained or rises. Critical base levels typically occur at or above the level of the adjacent ground surface. The monitoring system will not indicate when seepage occurs. It can indicate when critical base level is reached and the length of time it is maintained.

Conclusions

1. Over the monitoring period, groundwater levels and river stage did not rise to the land surface.
2. Over the monitoring period, seepage was not observed.
3. Geologic conditions most likely to allow seepage were found at Site 3.

Recommendations

Continue to monitor river stage and groundwater levels until seepage conditions are observed. The data will be used to determine the critical base level when seepage occurs.

References

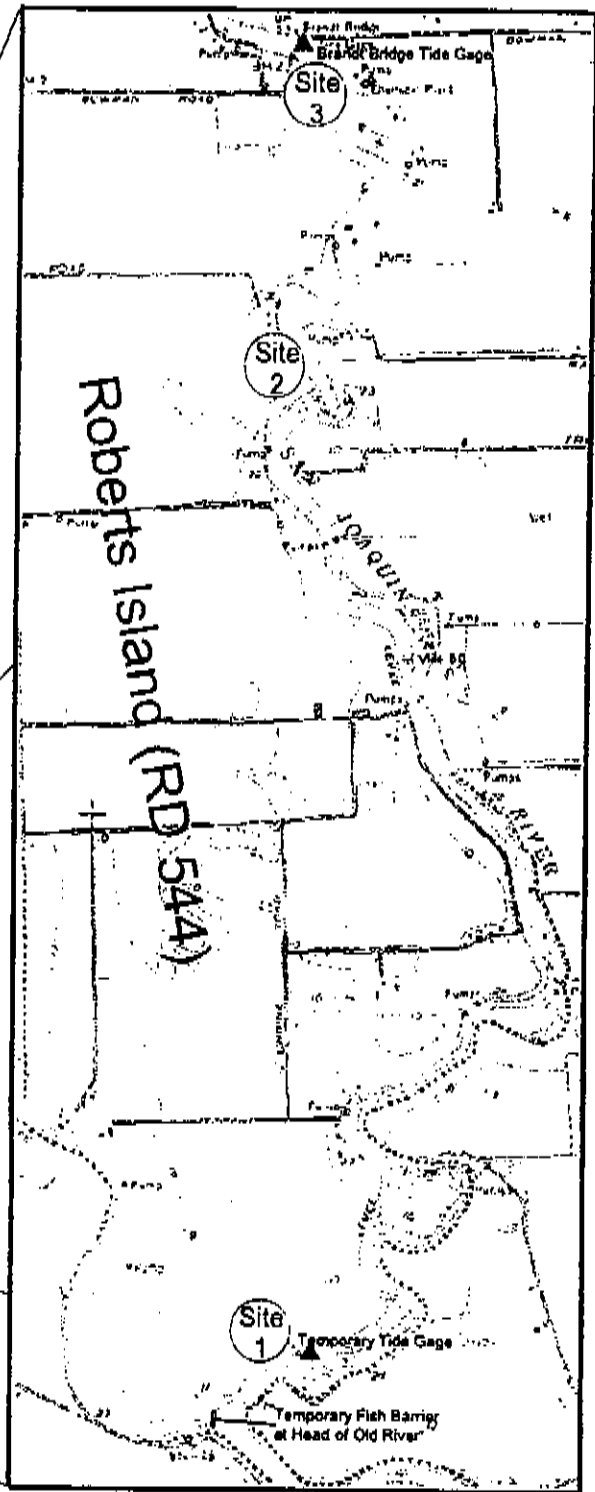
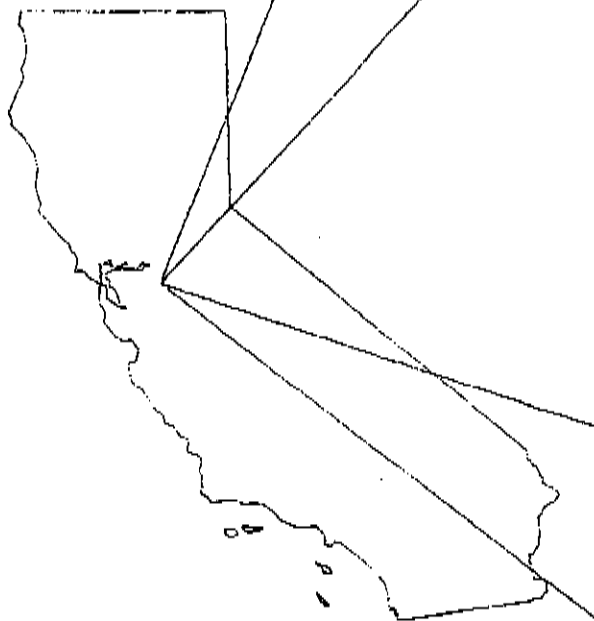
- Hills, Edward E. & Armstrong, George A. *Sacramento Valley Seepage Investigation*. California Department of Water Resources. Bulletin No. 125. 1967.
- Salah-Mars, Said & Luscher, Ulrich. *Supplemental Geotechnical Report: Levee Stability and Seepage Report for the Delta Wetlands Project Revised EIR/EIS*. URS Greiner Woodward Clyde. May 2000.
- California Department of Water Resources (DWR). 1999. *Temporary Barriers Project, 1998 Fishery, Water Quality, and Vegetation Monitoring Report, Sacramento, California*. 80 pp. plus appendices.
- California Department of Water Resources (DWR). 1998. *Temporary Barriers Project, 1997 Fishery, Water Quality, and Vegetation Monitoring Report, Sacramento, California*. 124 pp.
- California Department of Water Resources (DWR) and U.S. Bureau of Reclamation (USBR). 1999. *Biological Assessment, Effects of the Central Valley Project and State Water Project Operations From October 1998 Through March 2000 on Steelhead and Spring-run Salmon*. 211 pp.

Figures

Study Area and Site Locations

RD 544 Seepage Monitoring Study

Department of Water Resources
Central District
Geology and Groundwater Section



Scale



Figure 1

Topographic Map of Site 1

RD 544 Seepage Monitoring Study



Department of Water Resources
Central District
Geology and Groundwater Section

Legend



- ⊕ Monitoring Well
- △ Temporary Tide Gage
- Elevation Contour

Scale: 1 inch = 125 feet

50 0 50 100 150 200 250 Feet

Contour Interval 6 Feet
Datum is Mean Sea Level

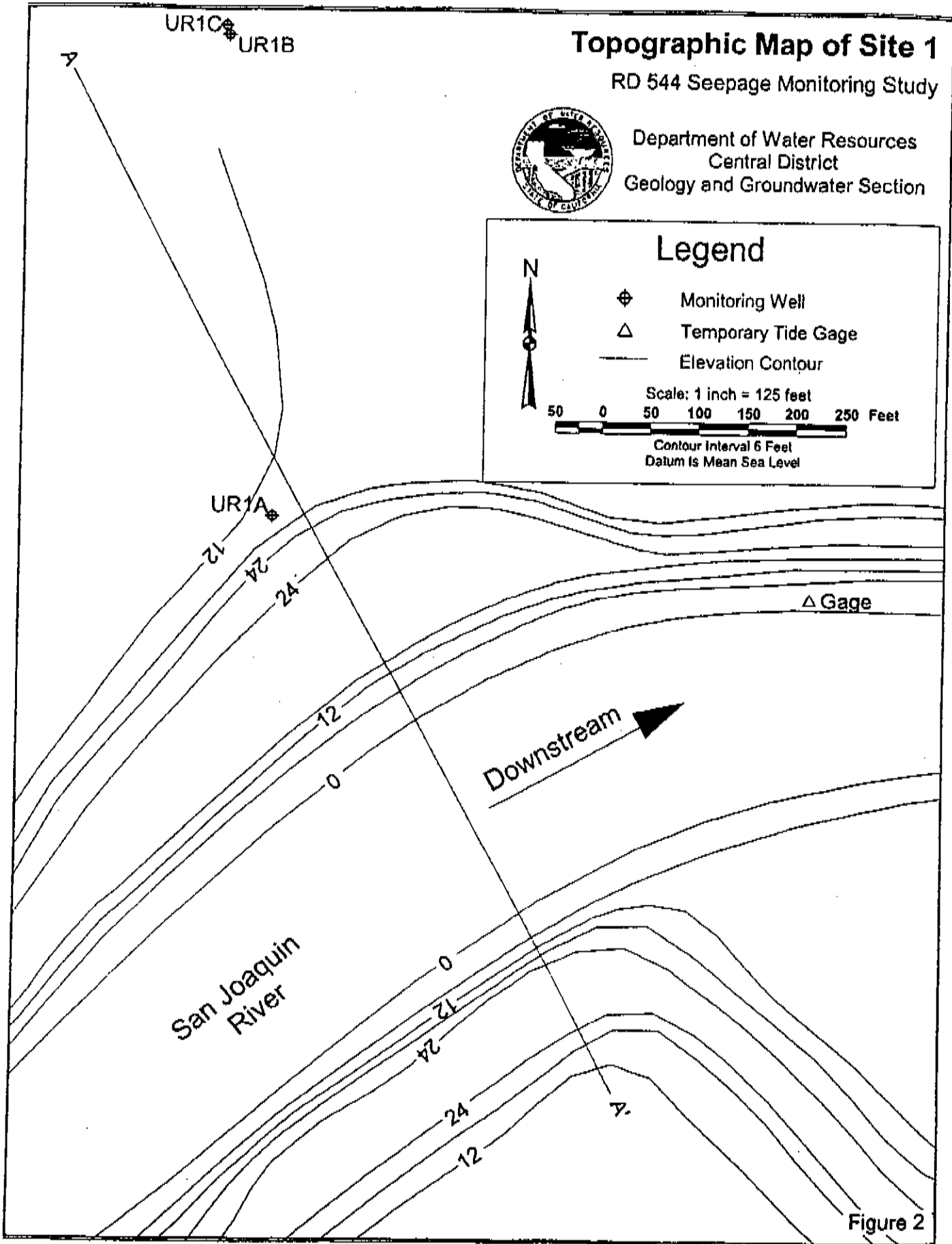
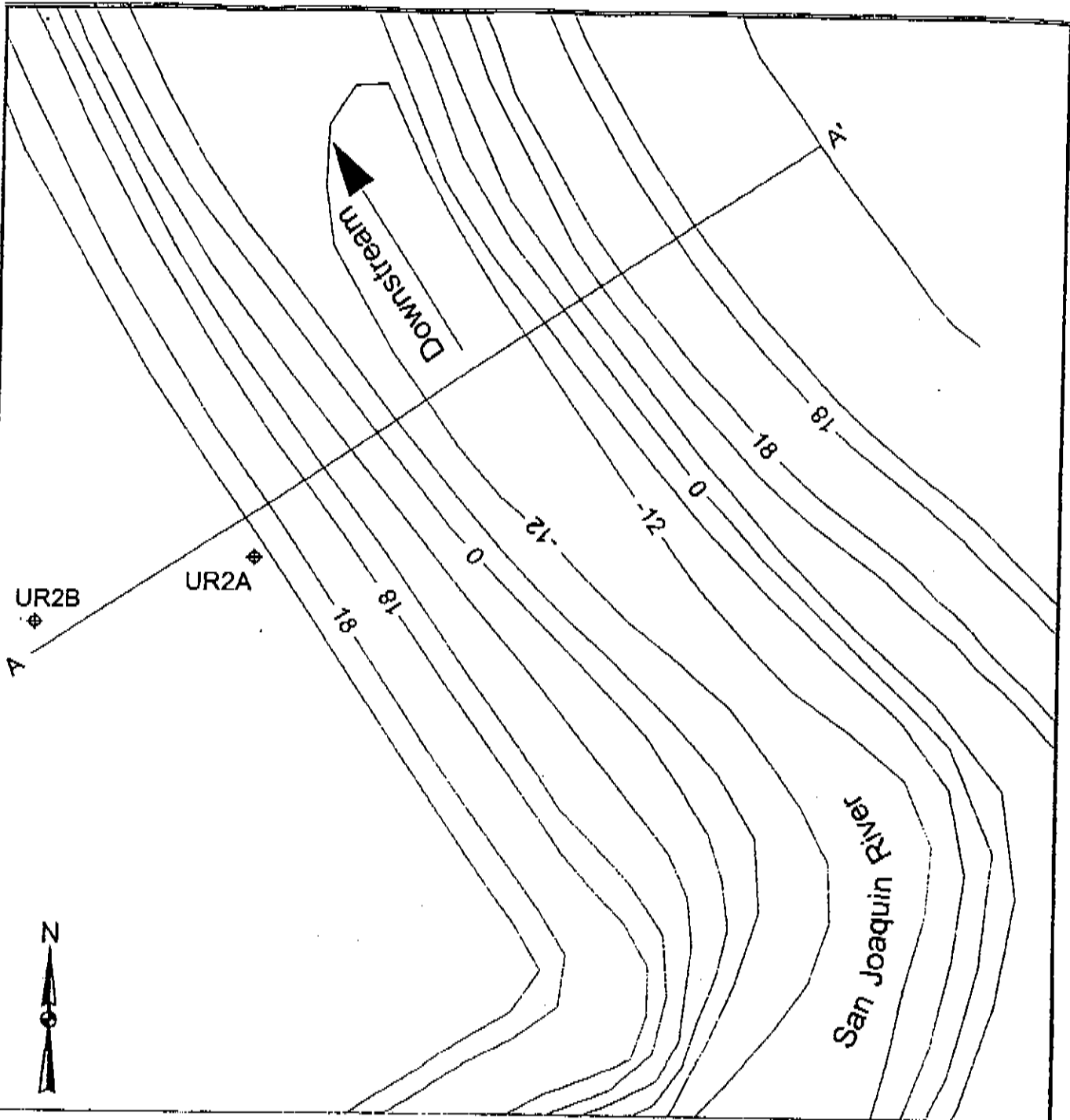


Figure 2



Legend

-  Monitoring Well
-  Elevation Contour

Scale: 1 inch = 100 feet



Contour Interval 6 Feet
Datum is Mean Sea Level

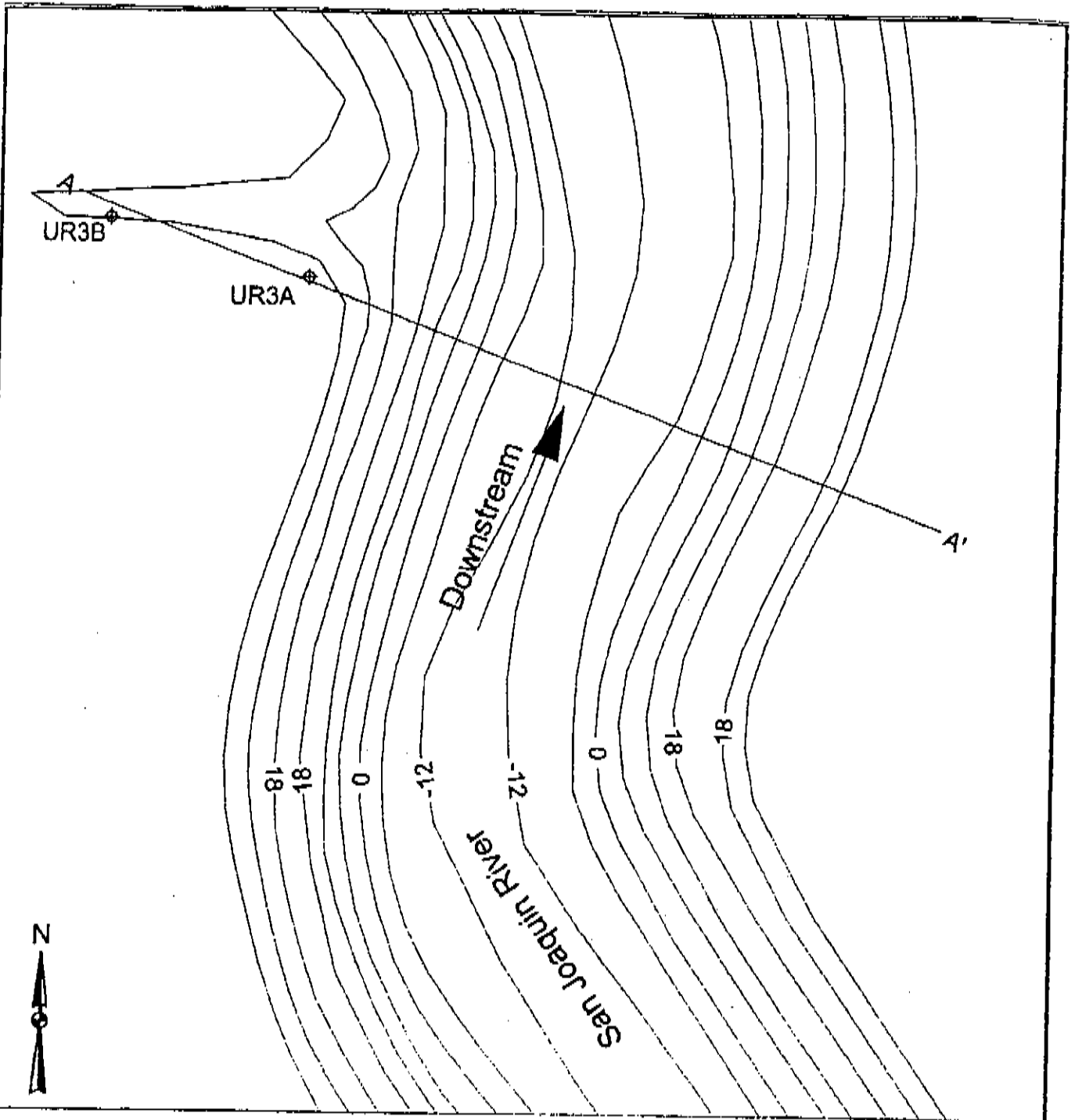
Topographic Map of Site 2

RD 544 Seepage Monitoring Study



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Central District
Geology and Groundwater Section

Figure 3



Legend

- ⊕ Monitoring Well
- Elevation Contour

Scale: 1 inch = 100 feet

100 0 100 200 Feet

Contour Interval 5 Feet
Datum is Mean Sea Level

Topographic Map of Site 3

RD 544 Seepage Monitoring Study



Department of Water Resources
Central District
Geology and Groundwater Section

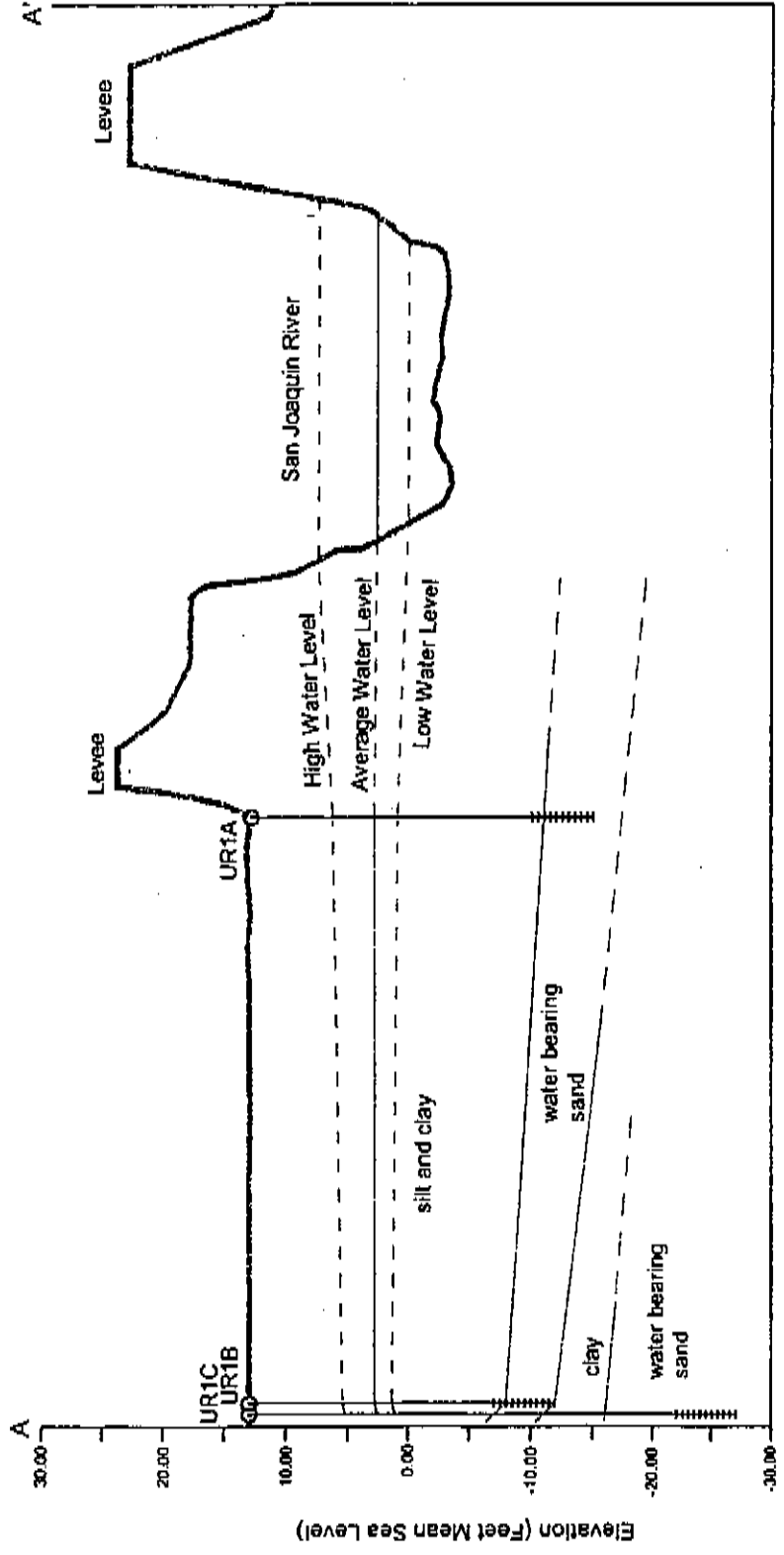
Figure 4

Figure 5

Hydrogeologic Cross Section A - A' of Site 1

RD 544 Seepage Monitoring Study

Department of Water Resources
Central District
Geology and Groundwater



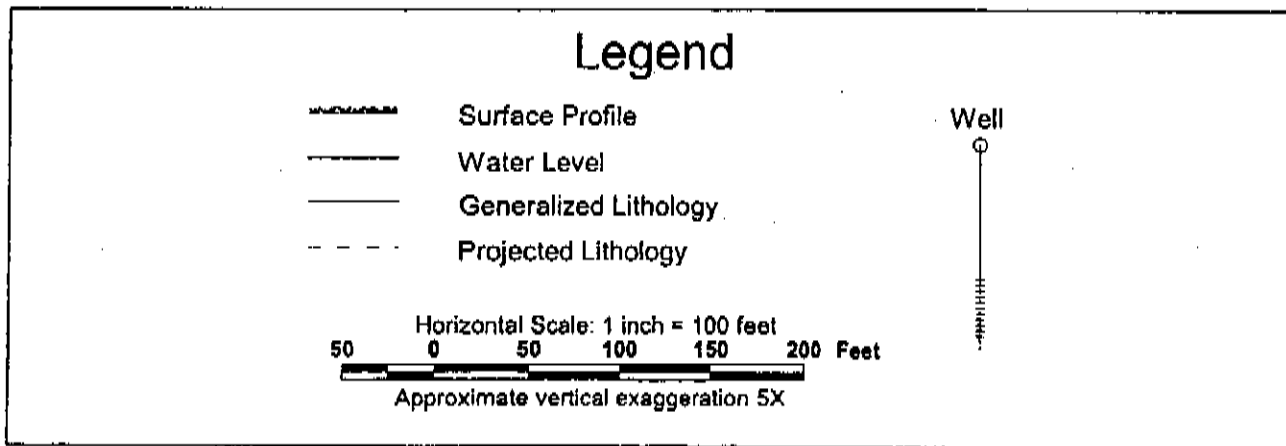
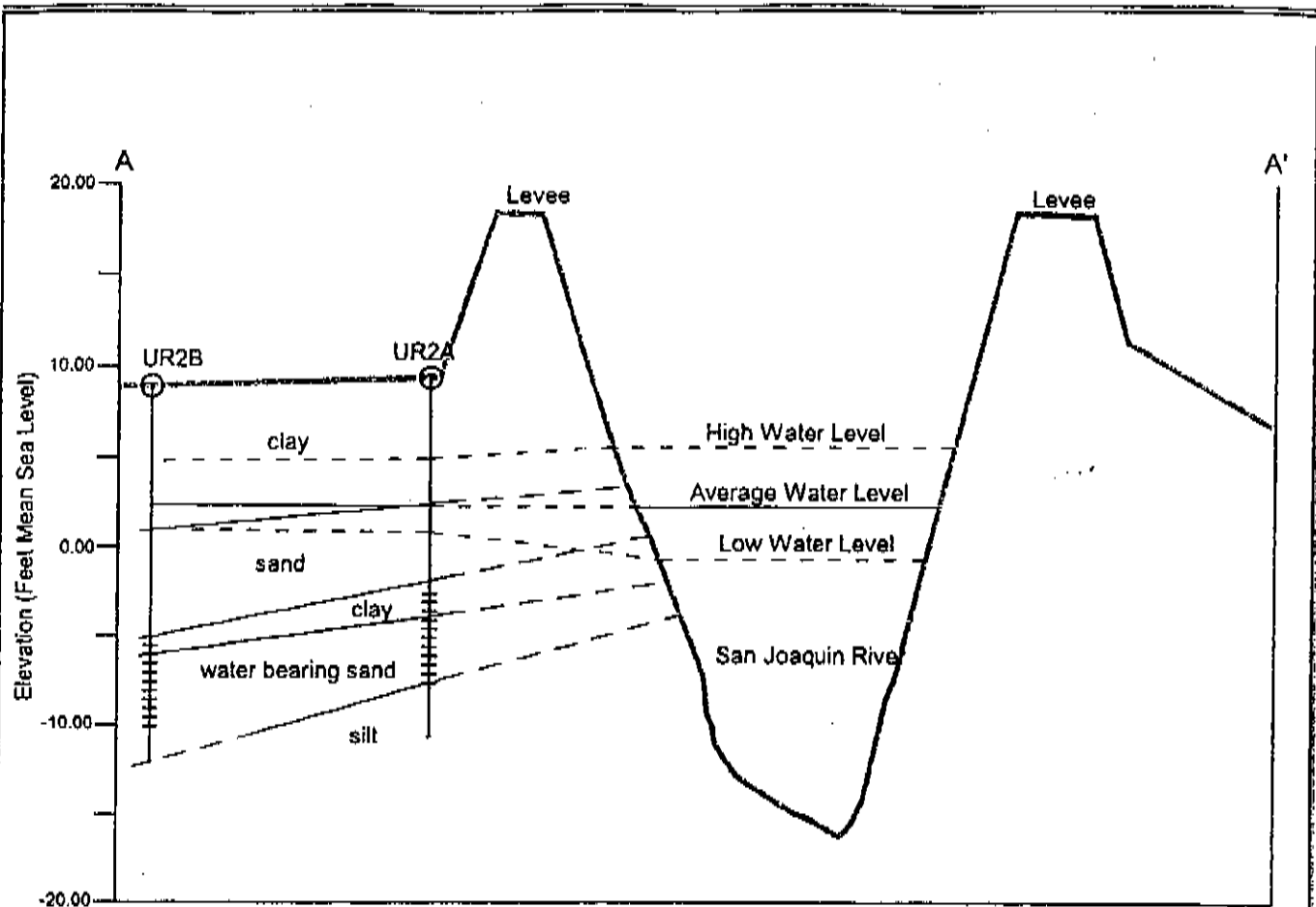
Legend

- Surface Profile
- - - Water Level
- Generalized Lithology
- - - Projected Lithology

Well

Horizontal Scale: 1 inch = 150 feet

Approximate vertical exaggeration 5X



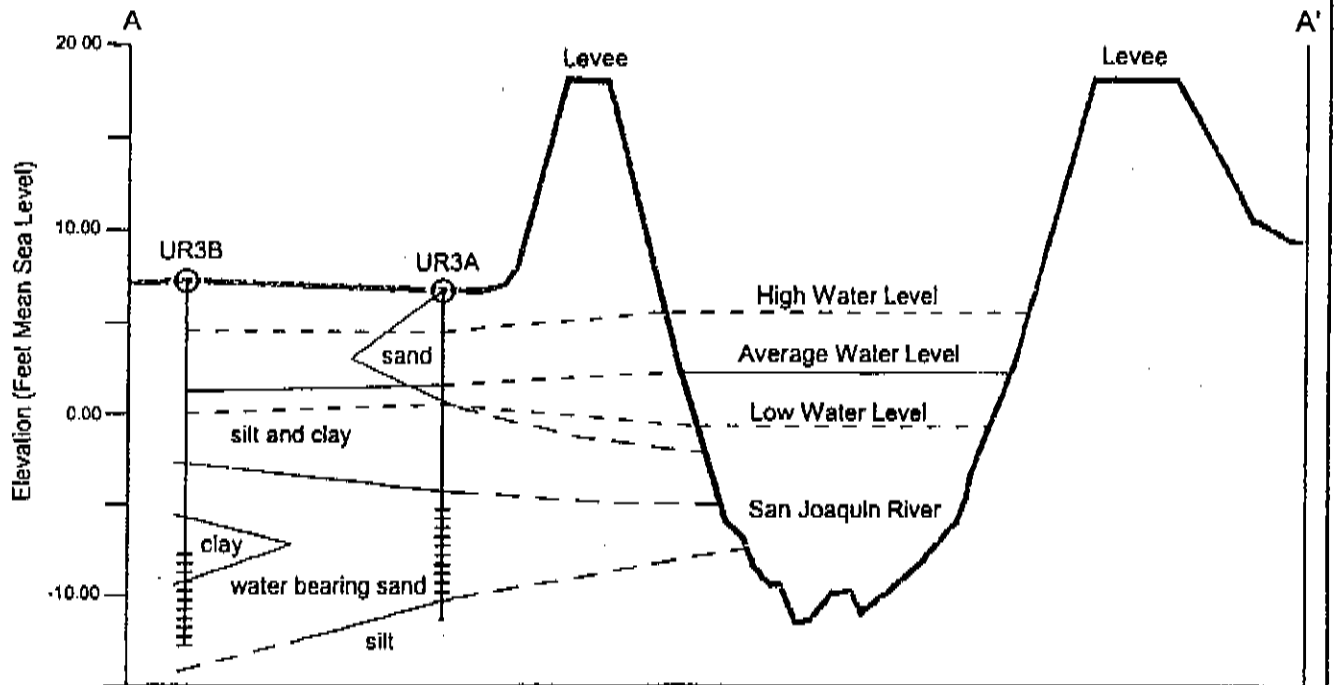
Hydrogeologic Cross Section A - A' of Site 2

RD 544 Seepage Monitoring Study





Department of Water Resources
Central District
Geology and Groundwater

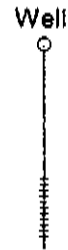


Figure 6



Legend

-  Surface Profile
-  Water Level
-  Generalized Lithology
-  Projected Lithology



Horizontal Scale: 1 inch = 100 feet
 50 0 50 100 150 200 Feet
 Approximate vertical exaggeration 5X

Hydrogeologic Cross Section A - A' of Site 3

RD 544 Seepage Monitoring Study

Department of Water Resources
 Central District
 Geology and Groundwater



Figure 7

San Joaquin River Stage
RD 544 Seepage Monitoring Study

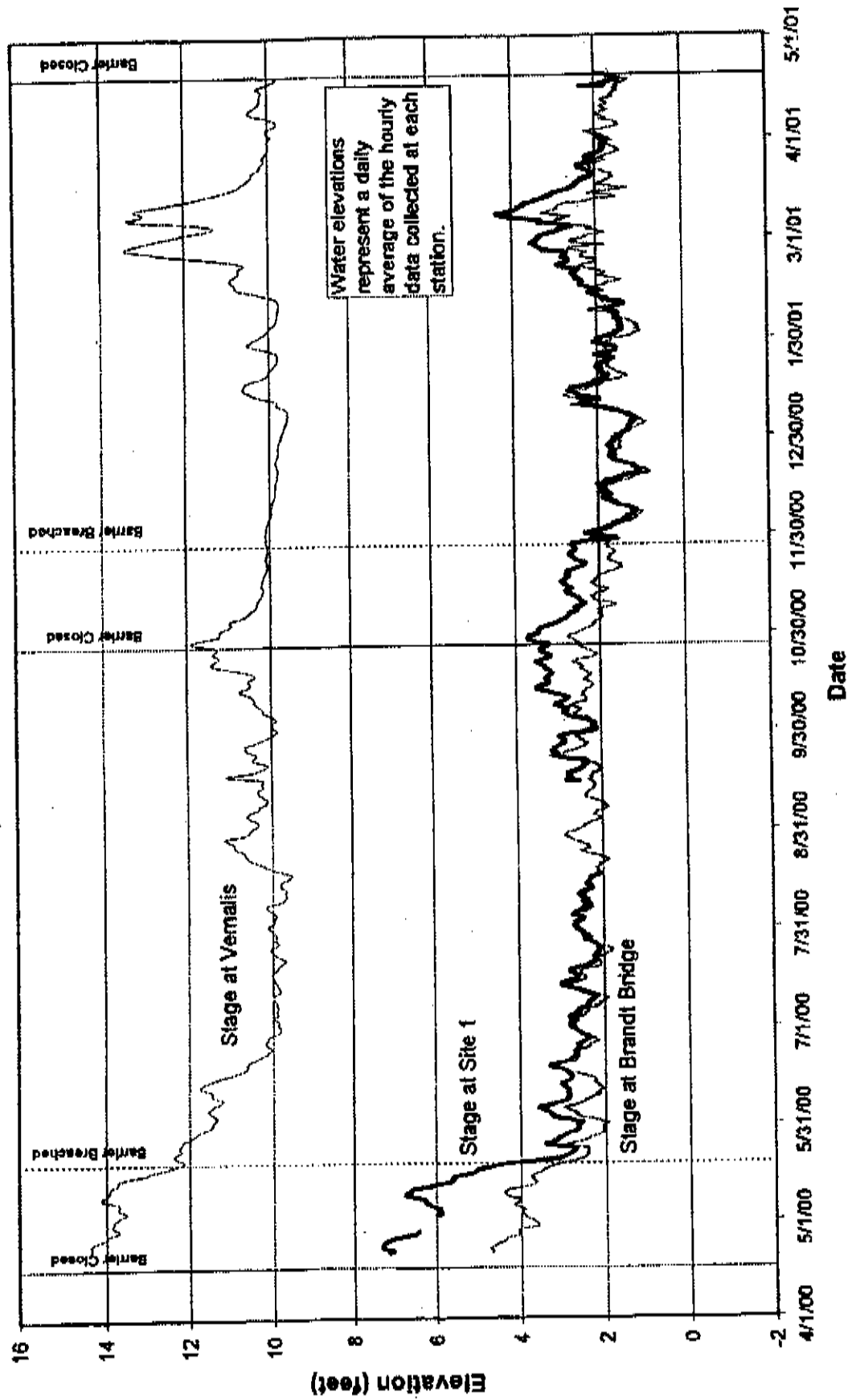


Figure 8

Central District Geology and Groundwater

San Joaquin River Stage and Groundwater Levels at Site 1

RD 544 Seepage Monitoring Study

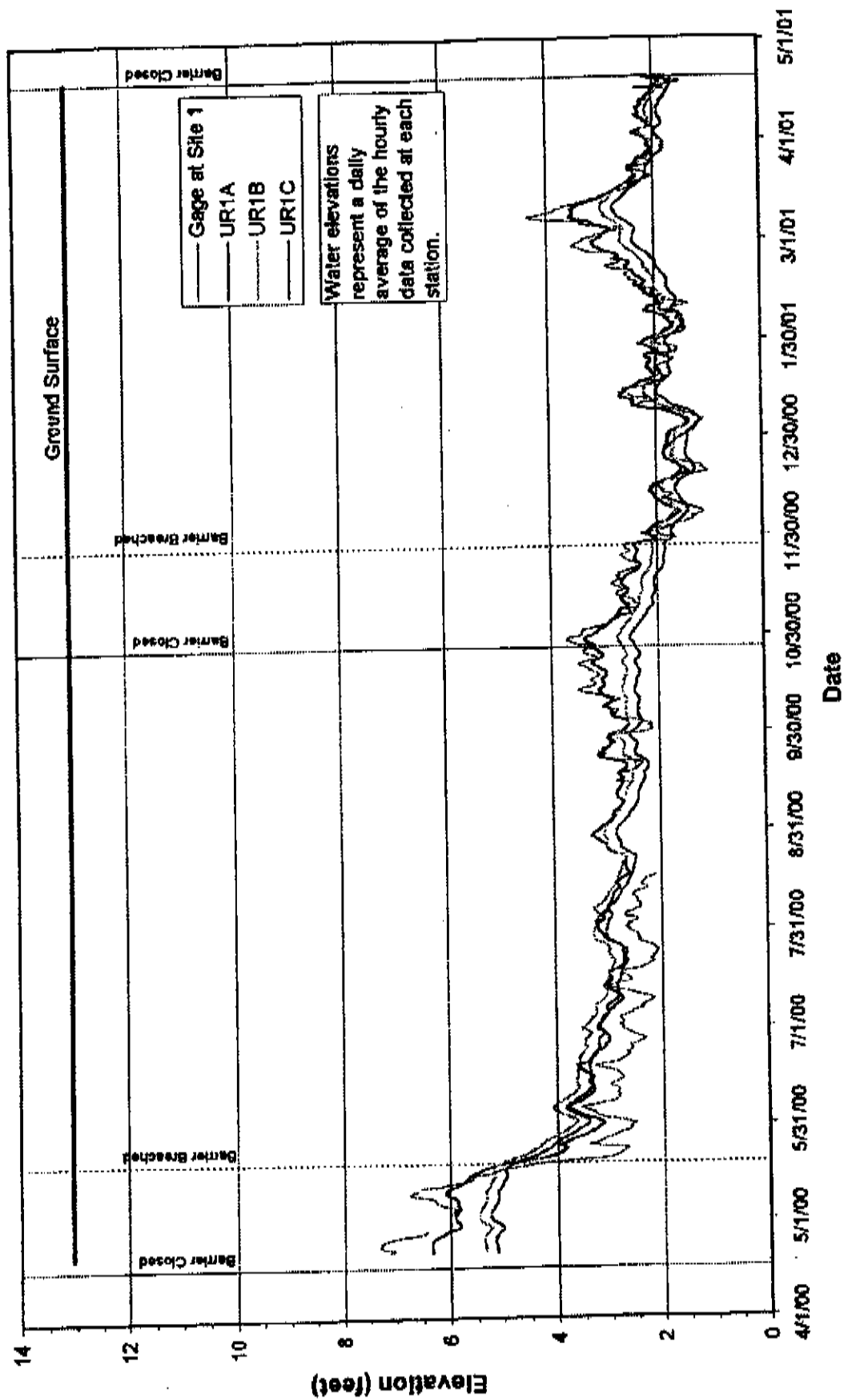


Figure 9

San Joaquin River Stage and Groundwater Levels at Site 1
RD 544 Seepage Monitoring Study

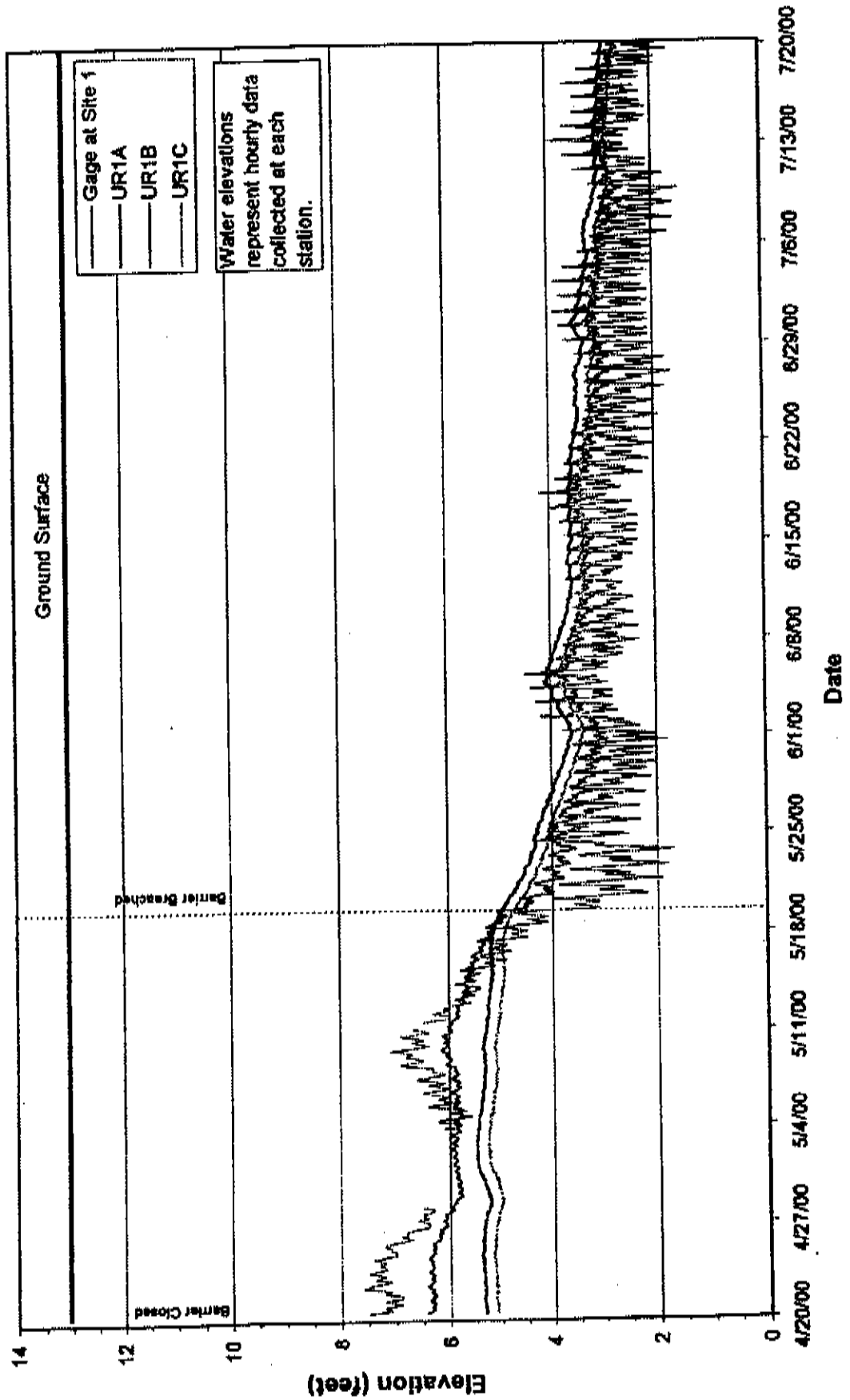
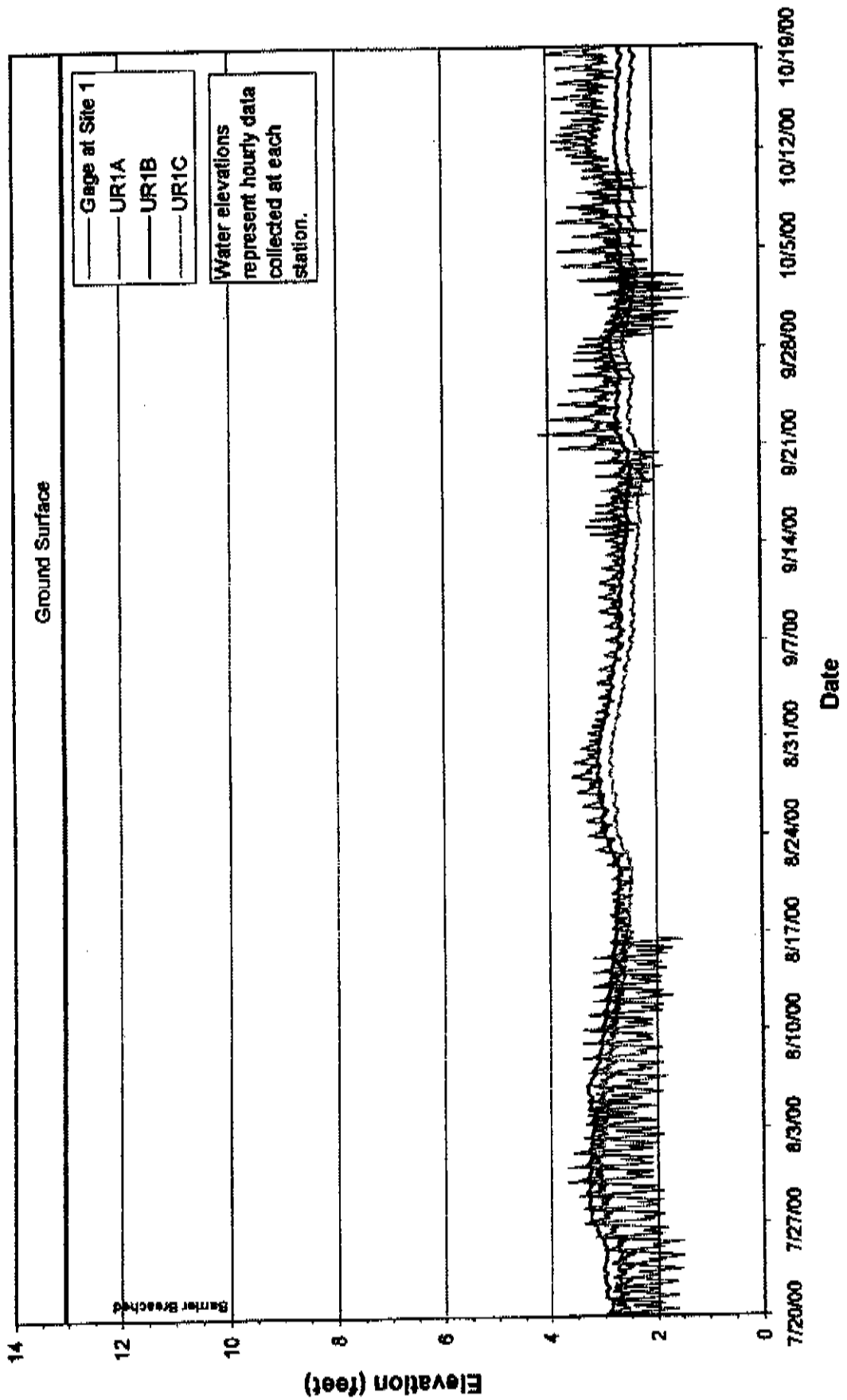


Figure 10

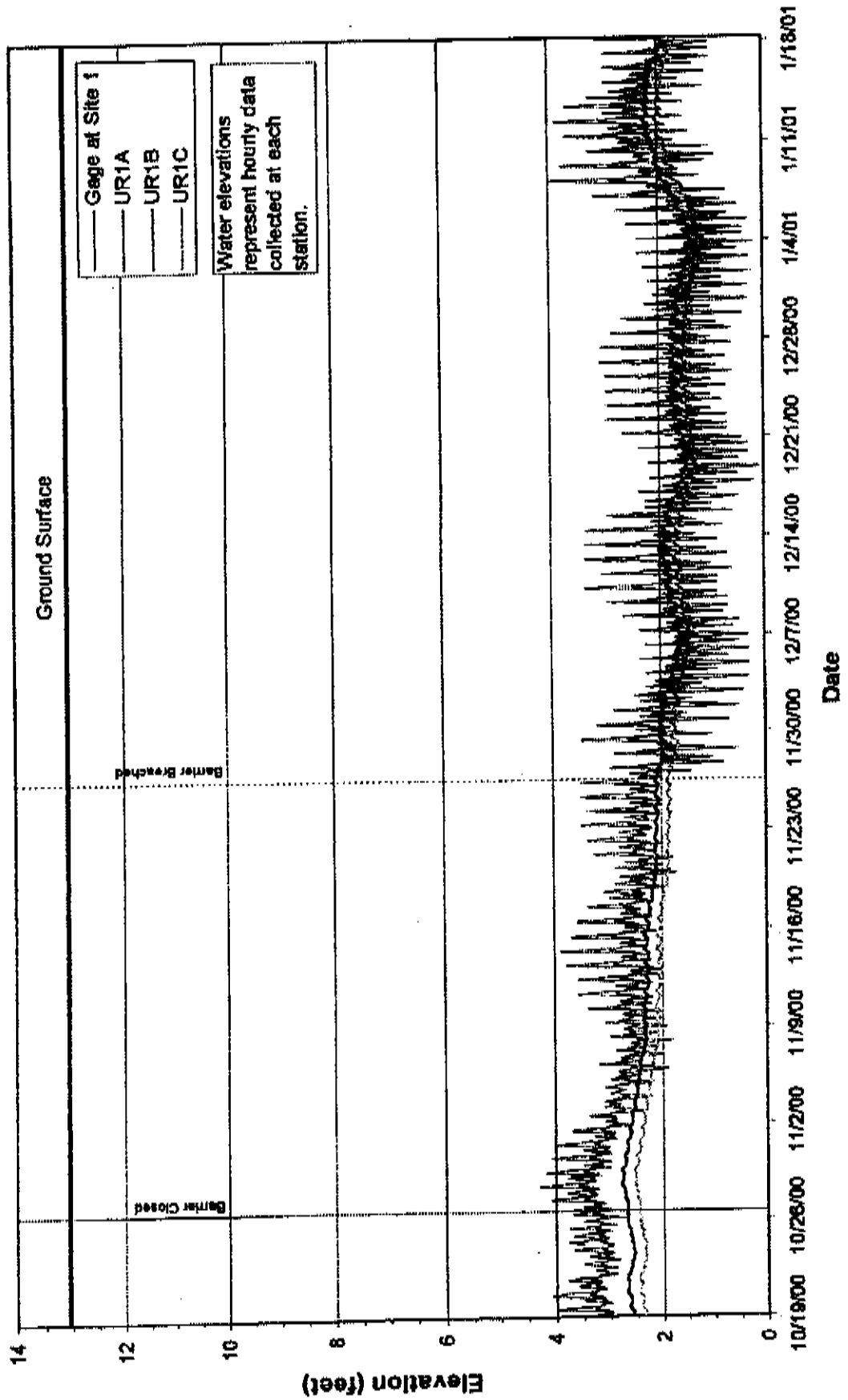
Central District Geology and Groundwater

San Joaquin River Stage and Groundwater Levels at Site 1
RD 544 Seepage Monitoring Study



San Joaquin River Stage and Groundwater Levels at Site 1

RD 544 Seepage Monitoring Study



San Joaquin River Stage and Groundwater Levels at Site 1
 RD 544 Seepage Monitoring Study

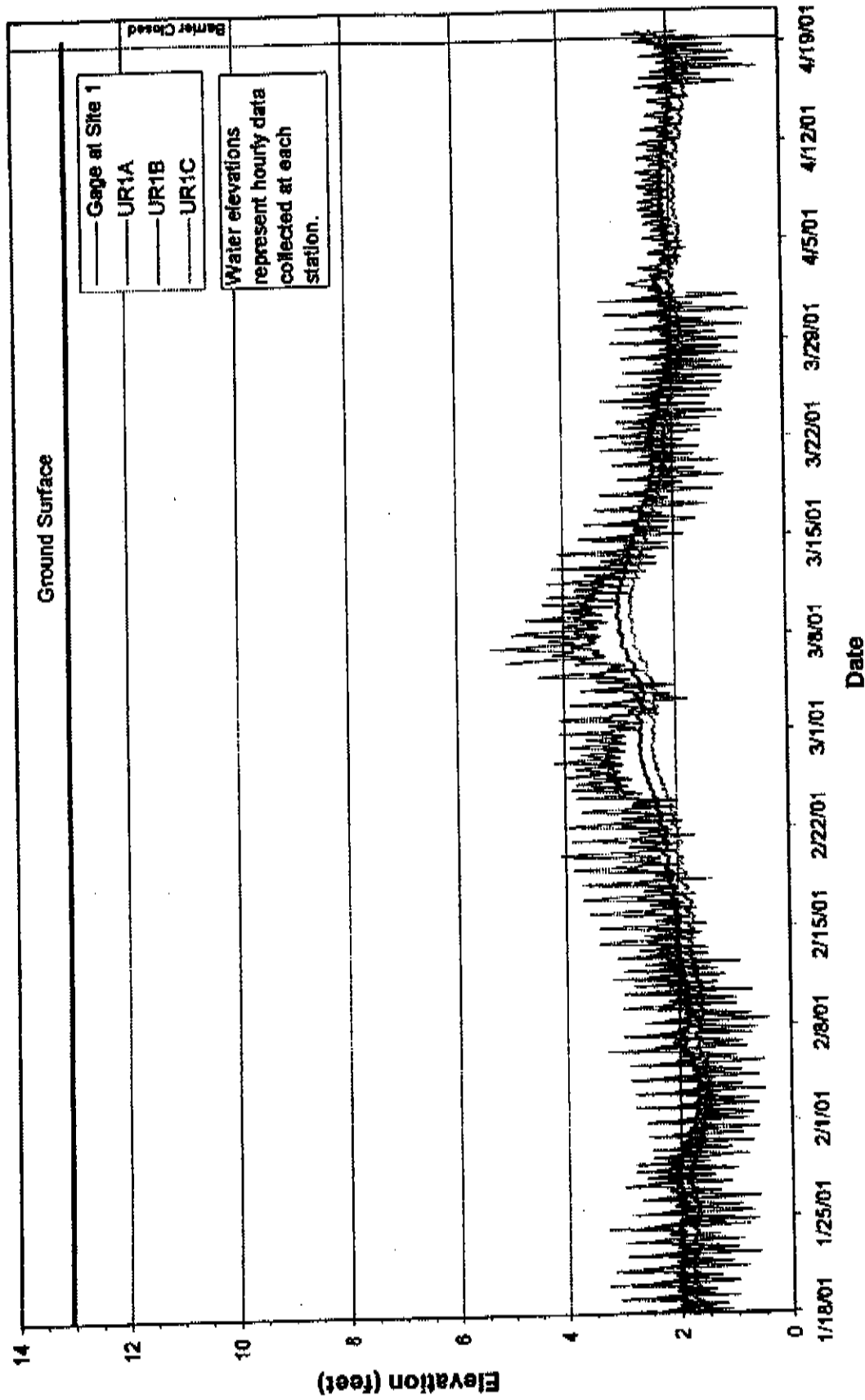


Figure 13

San Joaquin River Stage and Groundwater Levels at Site 2
 RD 544 Seepage Monitoring Study

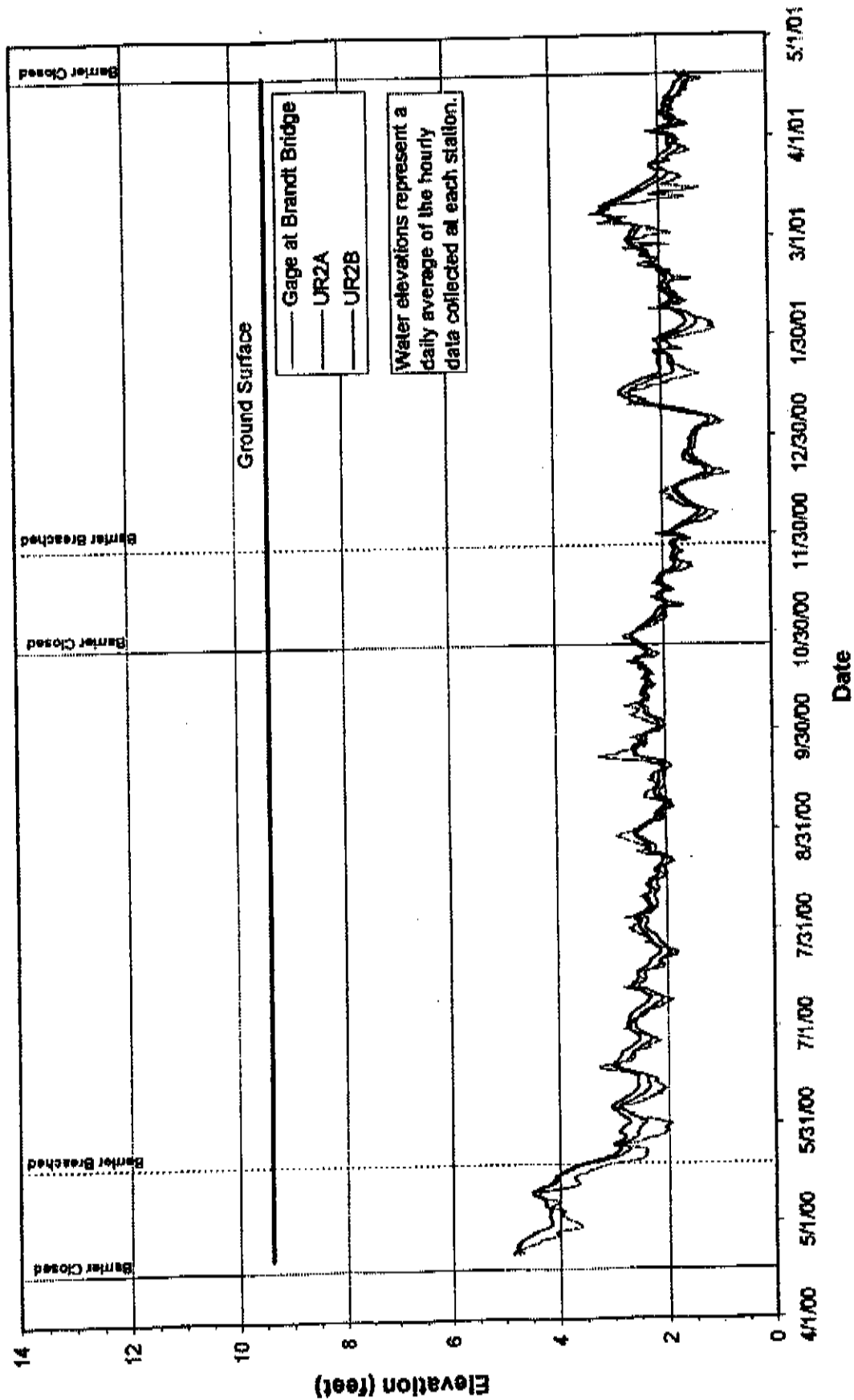


Figure 14

San Joaquin River Stage and Groundwater Levels at Site 3
 RD 544 Seepage Monitoring Study

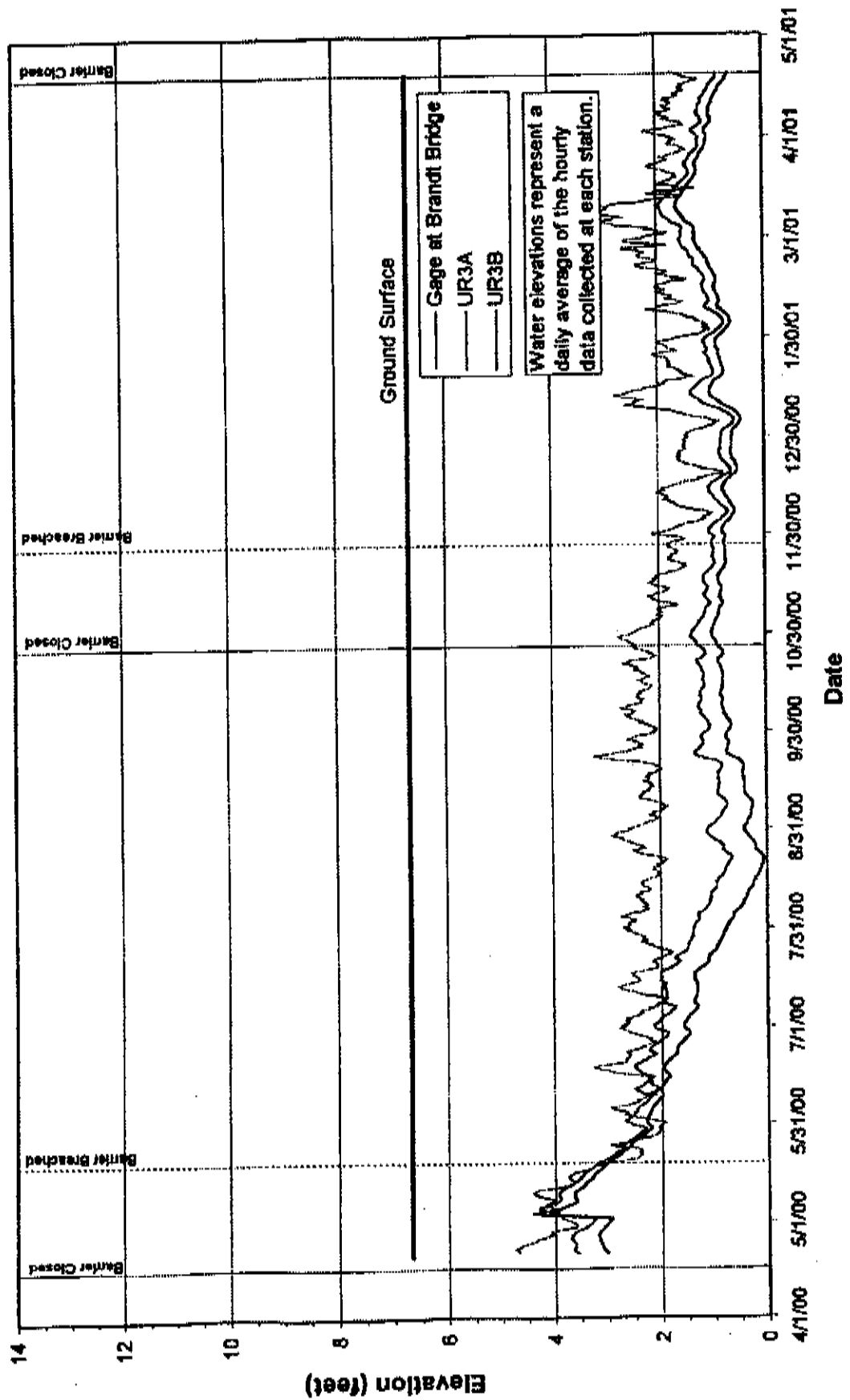


Figure 15

Appendix

Drill Hole Logs and Well Completions

DRILL HOLE LOG

PROJECT Reclamation District 544 Seepage Monitoring Study DATE DRILLED 04/06/00
FEATURE Monitoring Wells ATTITUDE Vertical
LOCATION _____ LOGGED BY William Brewster
CONTR. Layne-Christensen DRILL RIG CME 750 DEPTH TO WATER Not Determined

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
0.0 (13.06)		QUATERNARY ALLUVIUM DEPOSITS 0.0 to 30.0'		AD	CME Continuous Sampling
2.0		0.0 - 5.0' <u>No sample obtained</u> Cuttings indicate sandy soil.		NR	0.0 - 5.0' No sample obtained
4.0				0.0 5.0	
8.0	CL	5.0 - 9.0' <u>Silty Clay with Fine Sand (CL)</u> : About 50% medium plasticity clay; about 50% non-plastic fines; reddish gray; moist; soft to medium stiff.	1	2.0 2.0	2-foot sample
8.0			2	3.0 3.0	3-foot sample Clay in bottom of sampler.
10.0	SW	9.0 - 9.5' <u>Medium Sand (SW)</u> : About 95% well sorted, clean, medium sand; about 5% fines; yellowish brown; moist.			
12.0	CL	9.5 - 20.0' <u>Clay with Silt (CL)</u> : About 90% medium plasticity clay; about 10% non-plastic, micaeous fines; dark brown to gray; moist; soft to stiff.	3		
14.0				5.0 5.0	5-foot sample
16.0					Continued on next page.

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DEPARTMENT OF WATER RESOURCES
DRILL HOLE LOG

SHEET 2 OF 2
HOLE NO. UR-1-A

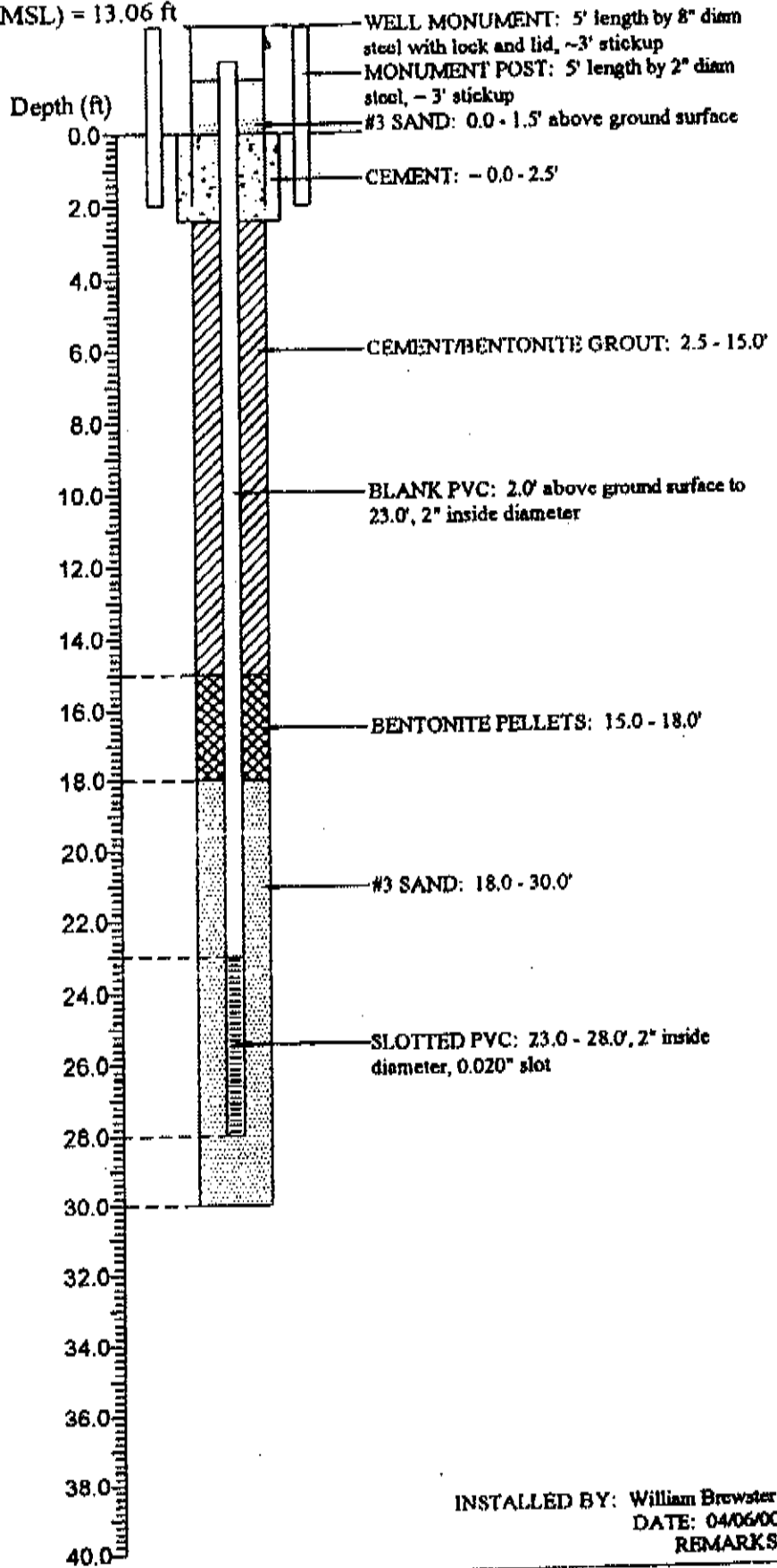
PROJECT & FEATURE **Reclamation District 544 Seepage Monitoring Study, Monitoring Wells**

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
16.0		QUATERNARY ALLUVIUM DEPOSITS 0.0 to 30.0'		AD	CME Continuous Sampling
18.0	CL	(cont.) 9.5 - 20.0' <u>Clay with Silt (CL)</u> : About 90% medium plasticity clay, about 10% non-plastic, micaceous fines; dark brown to gray; moist; soft to stiff.	5	<u>5.0</u> 5.0	5-foot sample
20.0		20.0 - 24.0' <u>Silt with Sand (ML)</u> : About 70% non-plastic fines; about 30% fine sand; olive-gray, wet.			
22.0	ML		6	<u>5.0</u> 5.0	5-foot sample
24.0		24.0 - 30.0' <u>Silty Sand (SM)</u> : About 85% fine to medium micaceous sand; about 15% non-plastic fines; grayish brown, saturated, medium dense.			
26.0			7	<u>0.5</u> 5.0	Lost the majority of sample down the hole due to loose, wet sand.
28.0	SM				
30.0 (-16.9)					Total Depth = 30.0 feet
32.0					
34.0					
36.0					

DWR 888 (2) (Rev. 9-84)

Monitoring Well Completion of UR-1-A

Ground Surface Elevation (MSL) = 13.06 ft
Datum (UTM NAD 83):



INSTALLED BY: William Brewster
DATE: 04/06/00
REMARKS:

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

SHEET 1 of 2
HOLE NO. UR-1-B
ELEV. 13.04 FEET
DEPTH 27.0 FEET

DRILL HOLE LOG

PROJECT Reclamation District 544 Seepage Monitoring Study DATE DRILLED 04/07/00
FEATURE Monitoring Wells ATTITUDE Vertical
LOCATION _____ LOGGED BY Mark Souverville
CONTR. Layne-Christensen DRILL RIG CME 750 DEPTH TO WATER Approximately 18 ft

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
0.0 (13.06)		QUATERNARY ALLUVIUM DEPOSITS 0.0 to 27.0'		AD	CME Continuous Sampling
2.0		0.0 - 7.0' <u>Sandy Silt (ML)</u> : About 80% non-plastic fines; about 20% fine to medium sand; olive-brown, damp, stiff.	1	1.0 5.0	1-foot sample Lost majority of sample down hole.
4.0	ML				
6.0					
8.0		7.0 - 15.5' <u>Sandy Clay (CL)</u> : About 85% reddish gray, medium plasticity clay; about 15% olive-gray, fine sand; damp to moist, soft to medium stiff. Increase in moisture, decrease in clay at 9'. Occurrence of calcichey and color change to gray-brown at 12'.	2	5.0 5.0	5-foot sample
10.0	CL				
12.0					
14.0					
16.0		15.5 - 21.0' <u>Sandy Silt (ML)</u> : About 75% non-plastic fines; about 25% very fine to fine sand; light olive-brown, moist, soft. Wet from 18.0 - 18.5'.	4	5.0 5.0	5-foot sample Continued on next page.
	ML				

DWR 888 (1) (Rev. 9-84)

State of California
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DEPARTMENT OF WATER RESOURCES
DRILL HOLE LOG

SHEET 2 OF 2
HOLE NO. UR-1-B

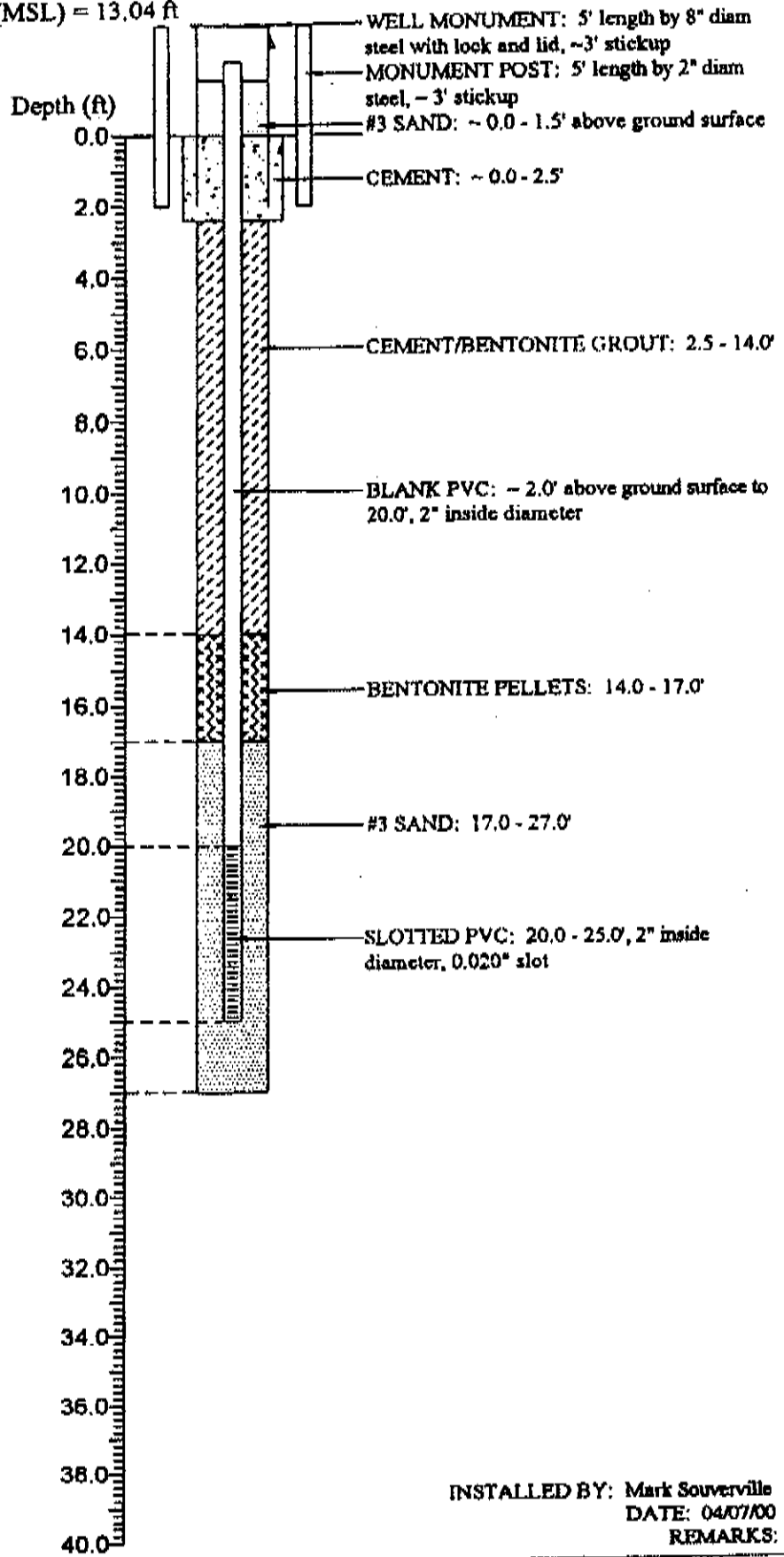
PROJECT & FEATURE **Reclamation District 544 Seepage Monitoring Study, Monitoring Wells**

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
18.0		QUATERNARY ALLUVIUM DEPOSITS 0.0 to 27.0'		AD	CME Continuous Sampling
18.0	ML	(cont.) 15.5 - 21.0' <u>Sandy Silt (ML)</u> : About 75% non-plastic fines; about 25% very fine to fine sand; light olive-brown, moist, wet from 18.0 - 18.5', soft.	4	$\frac{5.0}{5.0}$	5-foot sample
22.6	SM	21.0 - 25.0' <u>Silty Sand (SM)</u> : About 85% fine to medium micaceous sand; about 15% non-plastic fines; grayish brown, saturated, medium dense.	5	$\frac{5.0}{5.0}$	5-foot sample
26.0	CL	25.0 - 27.0' <u>Sandy Clay (CL)</u> : About 85% medium plasticity clay; about 15% fine to medium sand; light olive-brown, moist to wet, stiff.	6	$\frac{2.0}{2.0}$	2-foot sample
(-14.0)					Total Depth = 27.0 feet
28.0					
30.0					
32.0					
34.0					
36.0					

DWR 885 (2) (Rev. 9-84)

Monitoring Well Completion of UR-1-B

Ground Surface Elevation (MSL) = 13.04 ft
Datum (UTM NAD 83):



State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

SHEET 1 of 3
HOLE NO. UR-1-C
ELEV. 13.01 FEET
DEPTH 40.0 FEET

DRILL HOLE LOG

PROJECT Reclamation District 544 Seepage Monitoring Study DATE DRILLED 04/07/00
FEATURE Monitoring Wells ATTITUDE Vertical
LOCATION _____ LOGGED BY Mark Souverville
CONTR. Layne-Christensen DRILL RIG CME 750 DEPTH TO WATER Approximately 18 ft

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
0.0 (13.06)		QUATERNARY ALLUVIUM DEPOSITS 0.0 to 40.0'		AD	CME Continuous Sampling
2.0	ML	0.0 - 5.0' <u>Sandy Silt (ML)</u> : About 80% non-plastic fines; about 20% fine to medium sand; olive-brown, damp, stiff.	1	1.5 5.0	1.5-foot sample Lost majority of sample down hole.
4.0					
6.0		5.0 - 14.5' <u>Sandy Clay (CL)</u> : About 80% medium plasticity clay; about 20% fine to medium sand; olive-brown, damp to moist medium stiff, very stiff 12 - 13'.	2	5.0 5.0	Sluff from above fall in sample tube, projected contact from ML to CL. 5-foot sample
8.0					
10.0	CL		3	5.0 5.0	5-foot sample
12.0					
14.0					
16.0	ML	14.5 - 20.0' <u>Sandy Silt (ML)</u> : About 75% non-plastic fines; about 25% very fine to fine sand; light olive-brown, moist to wet, soft.	4	5.0 5.0	5-foot sample Continued on next page.

DWR 685 (1) (Rev. 9-84)

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
DRILL HOLE LOG

SHEET 2 OF 3
HOLE NO. UR-1-C

PROJECT & FEATURE **Reclamation District 544 Seepage Monitoring Study, Monitoring Wells**

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
16.0		QUATERNARY ALLUVIUM DEPOSITS 0.0 to 40.0'		AD	CME Continuous Sampling
18.0	ML	(cont.) 14.5 - 20.0' <u>Sandy Silt (ML)</u> : About 75% non-plastic fines; about 25% very fine to fine sand; light olive-brown, moist to wet, soft.	4	5.0 5.0	5-foot sample
20.0		20.0 - 24.0' <u>Silty Sand (SM)</u> : About 85% fine to medium micaceous sand; about 15% non-plastic fines; grayish brown, wet, medium dense.			
22.0	SM		5	5.0 5.0	5-foot sample
24.0		24.0 - 26.0' <u>Sandy Clay (CL)</u> : About 85% high plasticity clay; about 15% fine to coarse sand; light olive-brown with iron-oxide stains, wet to saturated, stiff.			
26.0	CL	26.0 - 29.0' <u>Clay with Silt (CL)</u> : About 90% high plasticity clay; about 10% non-plastic fines; yellow-brown (iron banding) to light olive-brown, moist to wet, stiff.	6	5.0 5.0	5-foot sample
28.0		29.0 - 40.0' <u>Silty Sand (SM)</u> : About 85% fine to medium micaceous sand; about 15% non-plastic fines; light olive-brown to olive-brown, saturated, loose. Mica increases with depth.			
30.0	SM		7	5.0 5.0	5-foot sample
32.0					
34.0					
36.0			8	5.0 5.0	5-foot sample Continued on next page.

DWR 688 (2) (Rev. 9-84)

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
DRILL HOLE LOG

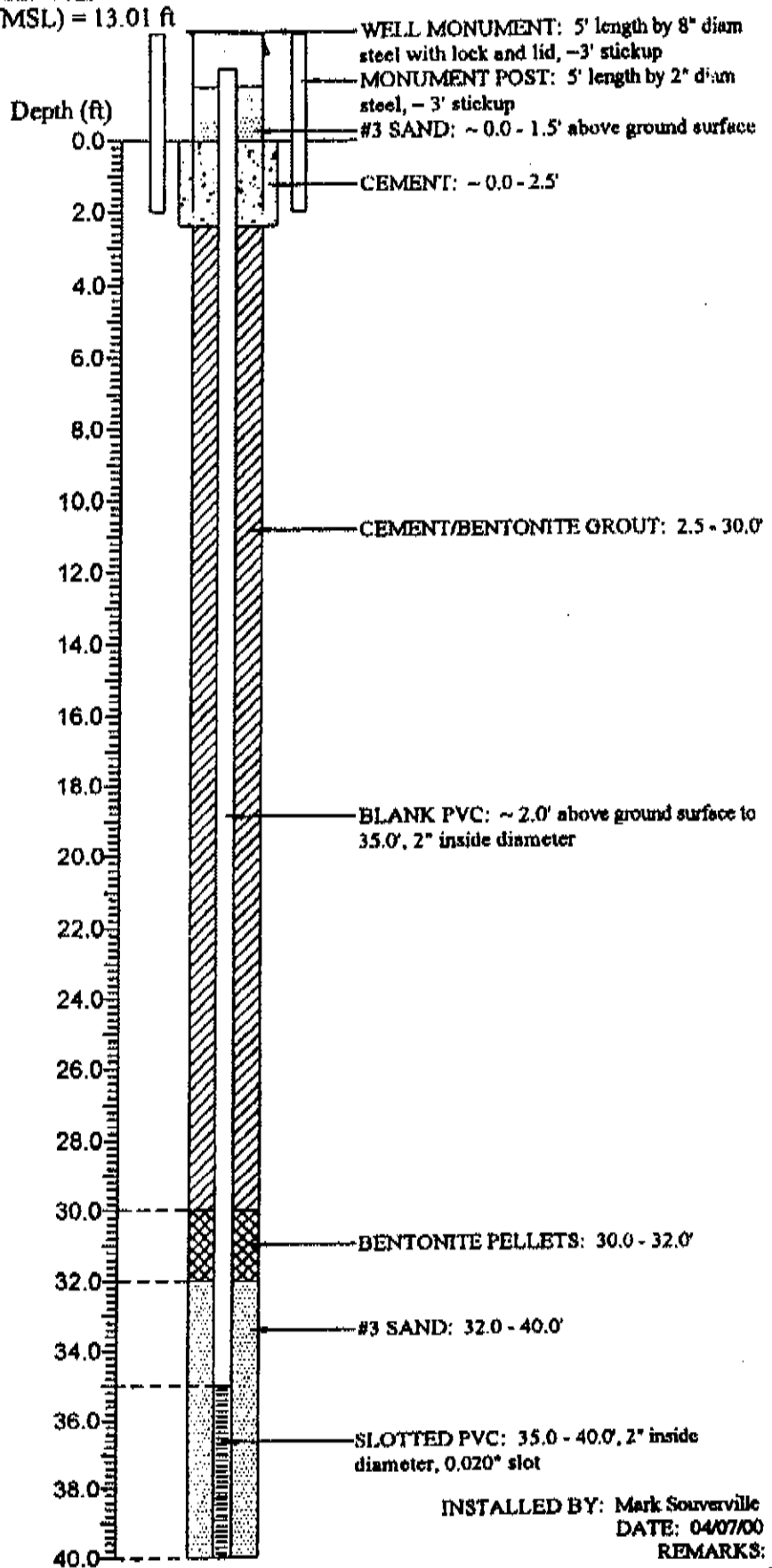
SHEET 3 OF 3
HOLE NO. UR-1-C

PROJECT & FEATURE **Reclamation District 544 Seepage Monitoring Study, Monitoring Wells**

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
36.0	(GP)s.c	QUATERNARY ALLUVIUM DEPOSITS 0.0 to 40.0' (cont.) 29.0 - 40.0' <u>Silty Sand (SM)</u> : About 85% fine to medium micaceous sand; about 15% non-plastic fines; light olive-brown to olive-brown, saturated, loose. Mica increases with depth.		AD	CME Continuous Sampling
38.0			6	5.0 5.0	5-foot sample
40.0 (-27.0)					Total Depth = 40 feet
42.0					
44.0					

Monitoring Well Completion of UR-1-C

Ground Surface Elevation (MSL) = 13.01 ft
Datum (UTM NAD 83):



INSTALLED BY: Mark Souverville
DATE: 04/07/00
REMARKS:

DRILL HOLE LOG

PROJECT Reclamation District 544 Seepage Monitoring Study DATE DRILLED 04/08/00
FEATURE Monitoring Wells ATTITUDE Vertical
LOCATION _____ LOGGED BY William Brewster
CONTR. Layne-Christensen DRILL RIG CME 750 DEPTH TO WATER Approximately 8 ft

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
0.0 (13.06)		<u>QUATERNARY ALLUVIUM DEPOSITS</u> 20.0'		AD	CME Continuous Sampling
2.0		0.0 - 5.0' <u>No sample obtained</u> Cuttings indicate sandy soil.		NR	0.0 - 5.0' No sample obtained, fell out of sampler.
4.0				0.0 5.0	
6.0	CL	5.0 - 7.0' <u>Clay (CL)</u> : Brown; damp; stiff.	1	2.5 2.5	2.5-foot sample
8.0	SM	7.0 - 11.3' <u>Sand with Silt and Clay (SM)</u> : About 80% fine to medium sand; about 20% fines; light brown; moist.	2	2.5 2.5	2.5-foot sample
10.0					
12.0	CL	11.3 - 13.3' <u>Clay with Silt (CL)</u> : About 90% medium plasticity clay; about 10% non-plastic fines; brown to gray; wet; soft to stiff.	3		5-foot sample
14.0	SM	13.3 - 17.0' <u>Silty Sand (SM)</u> : About 85% medium to coarse sand; about 15% non-plastic fines; light brown; wet.		5.0 5.0	
16.0			4		Continued on next page.

State of California
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DEPARTMENT OF WATER RESOURCES
DRILL HOLE LOG

SHEET 2 OF 2
HOLE NO. UR-2-A

PROJECT & FEATURE **Reclamation District 544 Seepage Monitoring Study, Monitoring Wells**

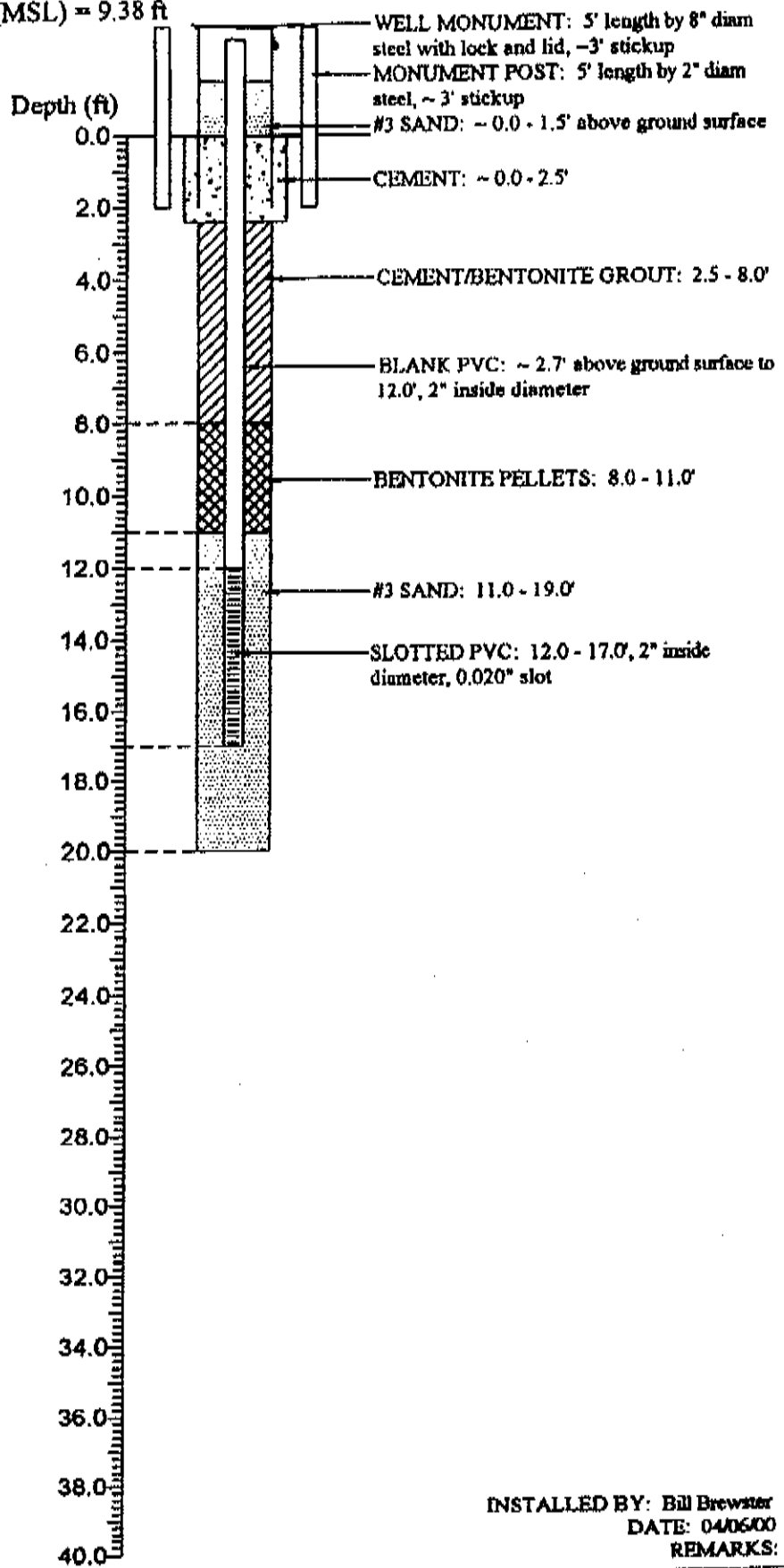
DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
18.0	SM	QUATERNARY ALLUVIUM DEPOSITS 0.0 to 20.0'		AD	CME Continuous Sampling
18.0		(cont.) 13.3 - 17.0' <u>Silty Sand (SM)</u> : About 85% medium to coarse sand; about 15% non-plastic fines; light brown; wet.	5	5.0 5.0	5-foot sample
20.0	ML	17.0 - 20.0' <u>Silty Sand with Clay (ML)</u> : About 60% fine sand; about 40% fines with slight plasticity; light brown, wet.			Total Depth = 20.0 feet
(-10.6)					
22.0					
24.0					
26.0					
28.0	SM				
30.0					
32.0					
34.0					
36.0					

DWR 005 (3) (Rev. 9-84)

Reclamation District 544 Seepage Monitoring Study

Monitoring Well Completion of UR-2-A

Ground Surface Elevation (MSL) = 9.38 ft
Datum (UTM NAD 83):



DRILL HOLE LOG

PROJECT Reclamation District 544 Seepage Monitoring Study DATE DRILLED 04/08/00
FEATURE Monitoring Wells ATTITUDE Vertical
LOCATION _____ LOGGED BY William Brewster
CONTR. Layne-Christensen DRILL RIG CME 750 DEPTH TO WATER Approximately 17 ft

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
0.0 (8.96)		QUATERNARY ALLUVIUM DEPOSITS 0.0 to 21.0'		AD	CME Continuous Sampling
2.0		0.0 - 5.5' <u>Silty Clay (CL)</u> : About 70% low plasticity clay; about 30% non-plastic fines; mottled dark brown, dark grayish brown; moist; soft.		NR	0.0 - 5.0' No sample obtained
4.0	CL			0.0 5.0	
6.0		5.5 - 8.0' <u>Sandy Clay (CL)</u> : About 60% medium plasticity clay; about 40% medium sand; dark gray; moist; stiff.	1	2.5 2.5	2.5-foot sample
8.0		8.0 - 14.0' <u>Silty Sand (SM)</u> : About 80% medium sand; about 20% non-plastic fines; dark brown; moist.	2	2.5 2.5	2.5-foot sample
10.0	SM				
12.0			3		5-foot sample
14.0	CL	14.0 - 15.0' <u>Sandy Silty Clay (CL)</u> : About 50% clay; about 30% non-plastic fines; about 20% fine, micaceous sand; light brown; wet. 15.0 - 21.0' <u>Sand with Silt (SM)</u> : About 95% micaceous, fine to medium sand; about 5% non-plastic fines; light brown; moist; loose.		5.0 5.0	
16.0	SM		4		2.5-foot sample Continued on next page.

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DRILL HOLE LOG

SHEET 2 OF 2
HOLE NO. UR-2-B

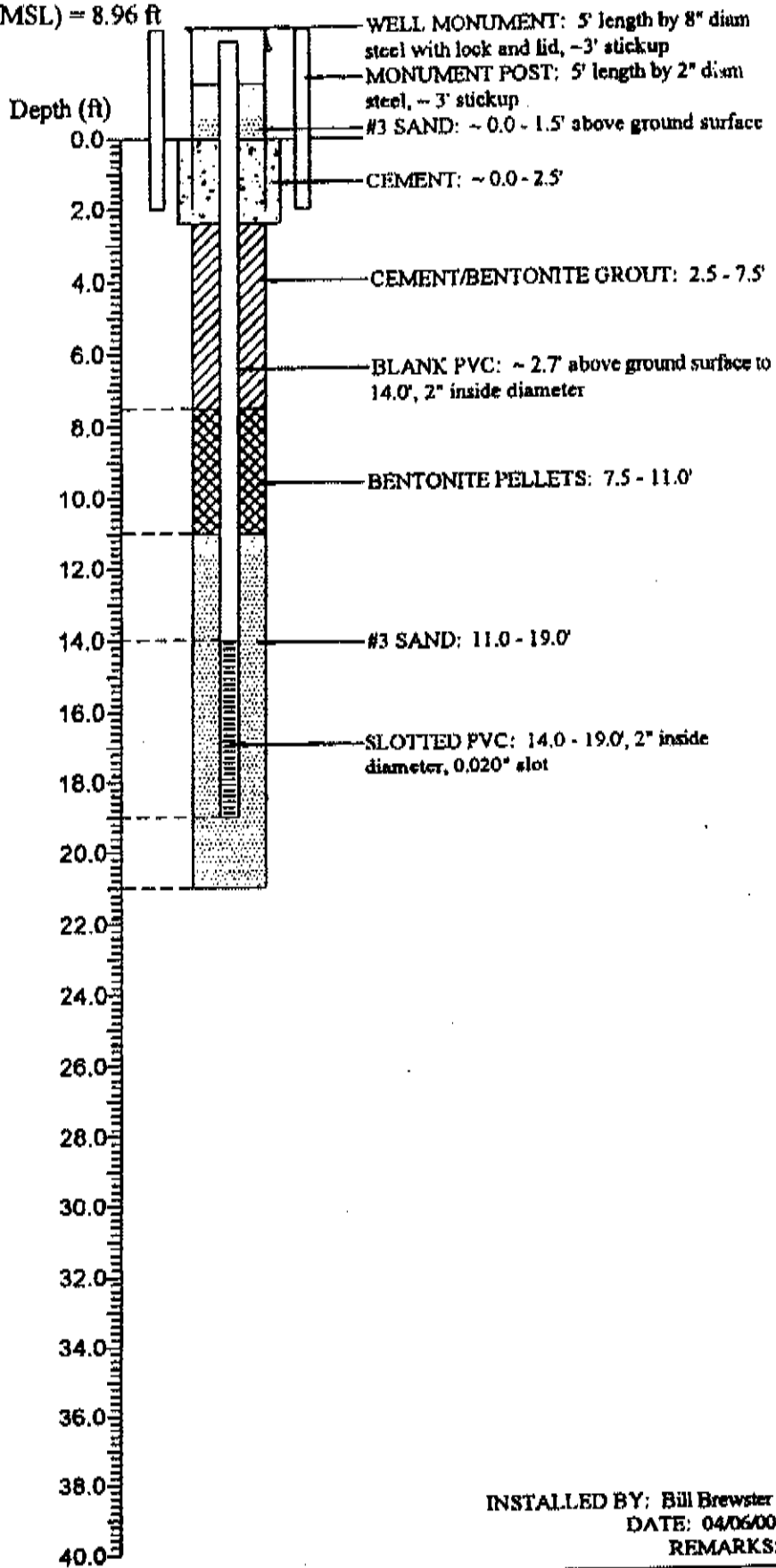
PROJECT & FEATURE **Reclamation District 544 Seepage Monitoring Study, Monitoring Wells**

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
18.0		QUATERNARY ALLUVIUM DEPOSITS 0.0 to 21.0'		AD	CME Continuous Sampling
18.0	SM	(cont.) 15.0 - 21.0' <u>Sand with Silt (SM)</u> : About 95% micaceous, fine to medium sand; about 5% non-plastic fines; light brown; moist, saturated at 17.5'; loose.	5	0.0 3.5	No sample retrieved, fell out of sampler due to high water content and loose soil.
20.0					
(-12.0)					Total Depth = 21.0 feet
22.0					
24.0					
26.0					
28.0					
30.0					
32.0					
34.0					
36.0					

DWR 888 (2) (Rev. 9-84)

Monitoring Well Completion of UR-2-B

Ground Surface Elevation (MSL) = 8.96 ft
Datum (UTM NAD 83):



State of California
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DEPARTMENT OF WATER RESOURCES

SHEET 1 of 2
HOLE NO. UR-3-A
ELEV. 6.67 FEET
DEPTH 18.0 FEET

DRILL HOLE LOG

PROJECT Reclamation District 544 Seepage Monitoring Study DATE DRILLED 04/05/00
FEATURE Monitoring Wells ATTITUDE Vertical
LOCATION _____ LOGGED BY Mark Souverville
CONTR. Layne-Christensen DRILL RIG CME 750 DEPTH TO WATER Approximately 11 ft

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
0.0 (8.96)		QUATERNARY ALLUVIUM DEPOSITS 0.0 to 18.0'		AD	CME Continuous Sampling
2.0	SM	0.0 - 4.0' <u>Silty Sand with trace Clay (SM)</u> : About 70% very fine to fine sand, some mica; about 30% non-plastic fines; dark grayish brown; moist; medium dense.	1	<u>3.5</u> 5.0	3.5-foot sample
4.0		4.0 - 6.0' <u>Silty Sand (SM)</u> : About 85% fine to medium sand, abundant mica; about 15% non-plastic fines; olive-brown; moist, wet from 5.0 - 5.6'; medium dense.			
6.0		6.0 - 11.0' <u>Silty Clay (CL)</u> : About 85% medium plasticity clay; about 15% non-plastic fines; very dark brown and dark gray; moist; soft.	2	<u>5.0</u> 5.0	5-foot sample
8.0	CL				
10.0		11.0 - 15.5' <u>Sand with Clay (SC)</u> : About 85% fine to medium sand; about 15% medium plasticity clay; olive-brown; wet, loose.	3		5-foot sample
12.0	SC				
14.0		15.5 - 17.0' <u>Silty Sand (SM)</u> : About 85% fine to medium sand, abundant mica; about 15% non-plastic fines; light brown; saturated; loose.	4	<u>5.0</u> 5.0	5-foot sample
16.0	SM				Continued on next page.

DWR 888 (1) (Rev. 9-84)

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
DRILL HOLE LOG

SHEET 2 OF 2

HOLE NO. UR-3-A

PROJECT & FEATURE **Reclamation District 544 Seepage Monitoring Study, Monitoring Wells**

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
16.0	SM	QUATERNARY ALLUVIUM DEPOSITS 0.0 to 18.0'	4	AD	CME Continuous Sampling Total Depth = 18.0 feet
	ML	(cont.) 15.5 - 17.0' <u>Silty Sand (SM)</u> : About 85% fine to medium sand, abundant mica; about 15% non-plastic fines; light brown; saturated; loose.		3.0 3.0	
18.0 (-11.3)		17.0 - 18.0' <u>Sandy Silt (ML)</u> : About 80% non-plastic fines, about 20% fine to medium sand, abundant mica; mottled yellowish brown and olive-gray; damp; medium stiff.			
20.0					
22.0					
24.0					
26.0					
28.0					
30.0					
32.0					
34.0					
36.0					

OWR 885 (2) (Rev. 9-84)

Reclamation District 544 Seepage Monitoring Study

Monitoring Well Completion of UR-3-A

Ground Surface Elevation (MSL) = 6.67 ft
Datum (UTM NAD 83):

