GROUND WATER FOR IRRIGATION IN THE MORGAN HILL AREA, CALIFORNIA.

By W. O. Clark.

INTRODUCTION.

LOCATION AND EXTENT.

The area covered by this investigation is a part of the Santa Clara Valley, Cal., lying about 20 miles southeast of the city of San Jose. It extends southeastward 4 miles and northwestward 6 miles from the village of Morgan Hill and occupies the entire width of the valley, which ranges from a little less than 2 miles to about 4 miles. (See Pl. V.)

Of the 15,730 acres [1] in the tract, about 8,500 acres,[2] exclusive of roads and stream bed, is included in a proposed irrigation district whose approximate boundaries are given as follows: Beginning at Perry station and following the Southern Pacific Co.'s line southeastward to Cochran road, thence along the State highway to Morgan Hill, thence following roughly the western border of the valley to the point where the railroad crosses Llagas Creek, thence along the railroad northwestward to Maple Avenue, thence along this avenue eastward to the border of the valley, thence along this border northward to a point east of Perry station, and thence back to that station. (See Pl. VI.)

The proposal to establish this irrigation district led the United States Department of Agriculture to request the Geological Survey to make a report on the possibility of obtaining ground water for irrigation before a final decision was reached in regard to plans based on a water supply to be obtained by storage on Coyote River. An investigation of this area was already in progress when the request was received, as a part of a more comprehensive ground-water survey, but the present special report was prepared to meet the immediate demand for information. The investigation was made in financial cooperation with the California State Department of Engineering and was under the direction of O. E. Meinzer, geologist in charge of

[1] Measured by planimeter on United States Geological Survey maps.

[2] Estimated by Mr. Andrew Swickard, the engineer who made a preliminary survey to determine the possibility of storing water on Coyote River for use in irrigating the area.

ground-water investigations. The levels were run by L. F. Biggs. The well logs were furnished by Mr. G. A. Hamilton, and records of the Bay Cities Water Co. were made available through the courtesy of Mr. H. L. Haehl. Numerous well measurements were made by residents of the area.

AGRICULTURAL CONDITIONS.

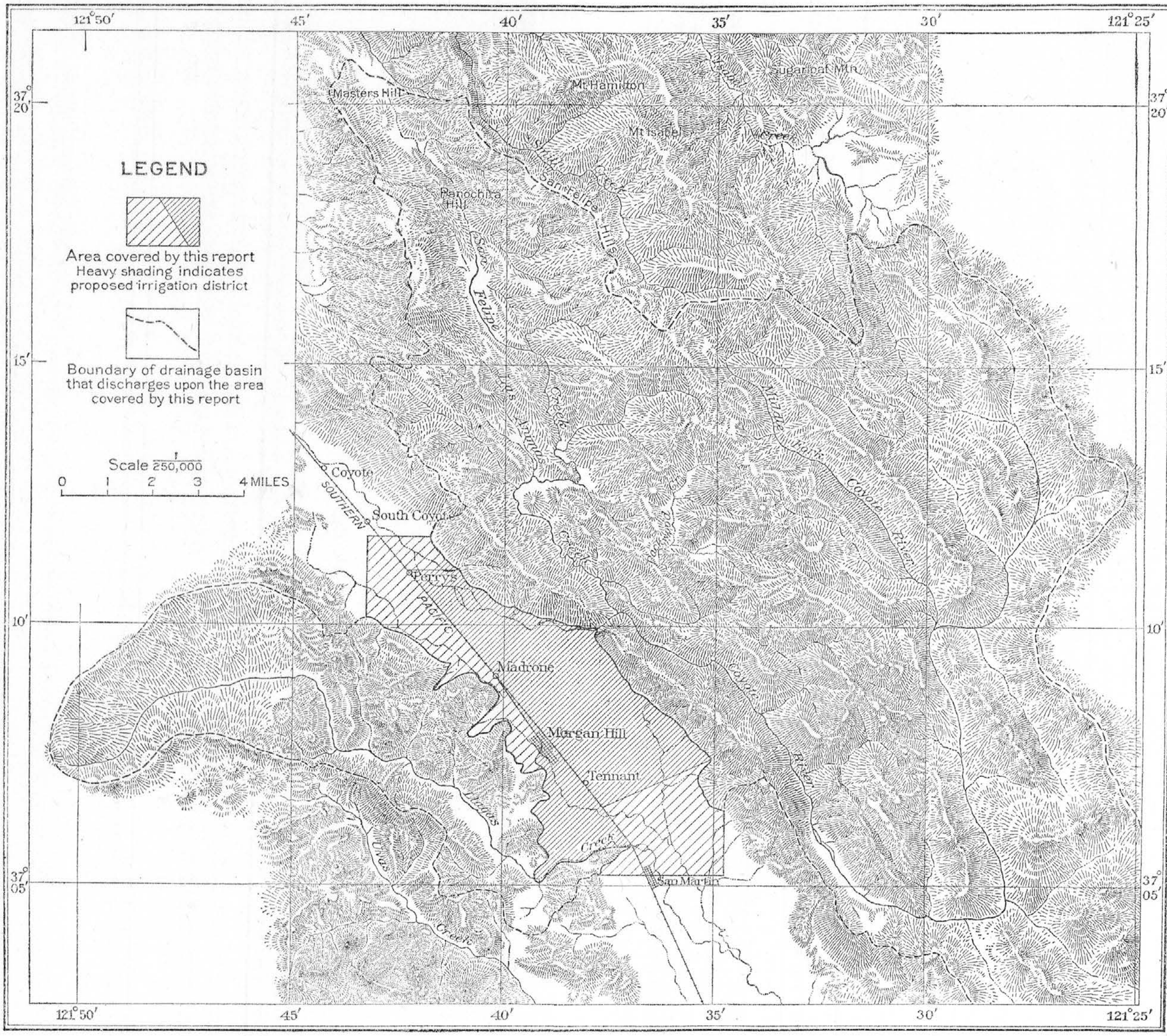
The soils of the region range from gravelly clay loam to a rather heavy sandy loam and vary widely in fertility. In the central part of the area, about Morgan Hill, they consist predominantly of coarse, angular gravel and on the whole are the least fertile in the area, though even in this locality they show rather wide variations in character and fertility, some of them being very open and porous and others comparatively tight and impervious. Adams [1] says: "It is stated locally that along the ridge that extends from the opening through which Coyote Creek enters the valley (upper gorge) to Morgan Hill the surface soil is in some places underlain with a hard stratum rendering the use of dynamite desirable prior to planting orchards. Both north and south of the central area the soils are more fertile and of a type that better retains moisture." Unless there is a superabundance of water for irrigation it would probably be necessary to deliver the water to the more porous soils either in lined ditches or in pipes, and surface pipe would perhaps be preferable on account of the ease with which the point of discharge could be shifted.

In the report above mentioned Adams states that no accurate crop survey has been made but that a careful local estimate made by Mr. Swickard gives 1,220 acres in vineyard, 1,595 acres in old orchard, 2,385 acres in young orchard, and 3,300 acres planted to annuals. He says:

> There is ample evidence that none of the old orchards in the area have produced much growth after coming into full bearing, and many of the trees have definitely gone backward and have been especially affected, it is stated, by several dry periods through which the area has passed. While this poor condition of the old orchards is not favorable, the young orchards in the area generally look well, indicating that here as elsewhere in the Santa Clara Valley the need for irrigation is not greatly felt until bearing commences. Absence of irrigation and poor soil management have undoubtedly been the governing factors in bringing about the present poor condition of the old orchards. * * * While some of the old orchards would plainly be better dug up than maintained even under irrigation conditions, it seems safe to assume that trees with strong wood that are not too old will be greatly benefited. * * * The need of irrigation if the Morgan Hill section is to continue permanently in the orchard business is conclusive.

The value of land in the vicinity of Morgan Hill ranges from about $150 an acre for bare land to $400 an acre for bearing orchards.

[1] Unpublished report by Frank Adams, irrigation manager, U. S. Dept. Agr.



MAP OF MORGAN HILL AREA, CAL., AND TRIBUTARY DRAINAGE BASINS.

PHYSIOGRAPHY AND DRAINAGE.

MOUNTAIN AREAS.

The highest and largest mountain area draining into the Santa Clara Valley lies east of it, and the largest drainage basin discharging into this portion of the valley is that of Coyote River. The mountain portion of the drainage basin of the Coyote has an area of 193.2 square miles,[1] which is about 82 per cent of the mountain area draining into this portion of the valley. The topography is rough, and considerable portions of the area stand at altitudes of 2,000 to 2,500 feet or more above sea level, and about the headwaters of the Coyote in Pine Ridge the altitude reaches 3,626 feet. The slopes of these mountains are practically barren of timber, and very little brush grows on them, so that the run-off is unobstructed and floods are frequent. The course of the Coyote is peculiar in that three times on its way out of the mountains it doubles on itself by sharp turns. In addition to the Coyote drainage basin there is on the east a foothill area of about 4 square miles that sends a small amount of water into this portion of the valley through a number of minor stream courses.

The largest drainage unit tributary to this portion of the valley from the west is that of Llagas Creek. This stream, which flows through the southwestern part of the valley into Pajaro River, drains a mountain area of about 32 square miles (determined by planimeter). This area is not so high nor so rugged as that on the east side of the valley. So far as present data show the highest point is Murphys Peak, about 1½ miles southwest of Morgan Hill, which stands 1,423 feet above sea level. Other peaks are 1,000 to 1,200 feet or more above the sea. Data are lacking as to altitudes about the headwaters of Llagas Creek, but this region is probably higher than Murphys Peak. Along the main stream courses in these western mountains there is more or less flat land, of which Paradise Valley, on the Llagas, is a notable example. There is also considerable flat land along Uvas Creek and its tributaries just south of the Llagas. The appearance of the whole border of hills on the west between Morgan Hill and Gilroy strongly suggests a recent settling of the region and a consequent partial filling of the canyons with alluvial materials. This gives the hills for 2 or 3 miles back of the valley border a more or less detached appearance. The mountains on the west side of the valley are largely covered with forest and the streams in general are more constant in their flow than those of equal drainage area entering from the east.

[1] McGlashan, H. D., and Stevens, G. C., Surface water supply of the United States, 1912, Part XI, Pacific coast basins in California: U. S. Geol. Survey Water-Supply Paper 331, p. 102, 1914.

VALLEY AREA.

The portion of Santa Clara Valley here considered contains the divide between the San Francisco Bay drainage and that of Monterey Bay. The lowest point in this divide is near the Higgins & Sterrett well (No. 84, Pl. VI), the mouth of which has an elevation of 353 feet above sea level. To the eye the valley floor appears to be nearly flat, but between Madrone and Coyote the average slope is about 15 feet per mile toward the northwest. South of the divide, from Morgan Hill to the United States Geological Survey bench mark about a mile south of Rucker, the average slope is about 17 feet per mile in a southeasterly direction. From the Higgins & Sterrett well to the mouth of the Coyote Canyon the surface rises at an average rate of about 25 feet per mile. (See Pl. V.)

About the mouth of Coyote Canyon an alluvial fan extending entirely across the valley has been built of the detritus carried by the stream from its upper and steeper course and dropped when it emerged upon the less steep valley floor. At the present time the Coyote flows down the northeastern slope of its fan near the Las Animas Hills for 7 or 8 miles until it reaches the narrow pass just below Coyote station, through which it discharges into the lower northwestern portion of Santa Clara Valley. This pass is the narrowest part of the valley, being only about one-fourth of a mile wide. (See Pl. V.)

FORMER DRAINAGE.

There is abundant physiographic evidence that Coyote River has not always flowed northward to San Francisco Bay, but that in former times it flowed southward and found its outlet through Pajaro Canyon into Monterey Bay. (See Pl. V.) It is highly probable that the outlet has alternated between San Francisco Bay and Monterey Bay many times. An alluvial fan of the form of the one at the mouth of the Coyote Canyon could have been built only by the shifting of the stream from side to side of the fan during its upbuilding; moreover, this is the common procedure of streams flowing over alluvial fans.

Biologic evidence of a geologically recent fresh-water connection between the streams flowing into Monterey Bay and those flowing into San Francisco Bay is afforded by the striking resemblance of the fish faunas of these two drainage basins, which are now separated by salt water. This connection could have been effected according to Branner,[1] by the alternating of the Coyote drainage between San Francisco Bay and Monterey Bay, together with a greater former elevation of the land. It is also thoroughly established that the whole coast region from San Francisco to San Diego formerly stood

[1] Branner, J. C., A drainage peculiarity of the Santa Clara Valley affecting fresh-water fauna: Jour. Geology, vol. 15, No. 1, pp. 1-9, 1907.

Base from unpublished topographic map
Additional levels by L. F. Biggs

Ground-water data by W. O. Clark

at a much higher level than it does now. The opinion has been advanced, first by Le Conte,[1] that the whole drainage of Sacramento and San Joaquin valleys formerly passed southward through the Santa Clara Valley and the Pajaro Canyon to the Bay of Monterey. However, the evidence is not believed to be sufficiently complete to warrant a conclusion on this matter.

GEOLOGY.

ROCK FORMATIONS.

In connection with this investigation the rock formations are important chiefly because they are the source of the materials composing the valley alluvium, because they are relatively impervious, and because of the effect of their topography on precipitation and run-off. The sedimentary rocks are in general firmly cemented and are largely of siliceous varieties, such as sandstone, chert, and jasper. There are also considerable quantities of metamorphic rocks, such as glaucophane schist, hornblende schist, and hornblende-garnet rocks. The igneous rocks are largely serpentine, greenstone, diabase, and diorite.

VALLEY ALLUVIUM.

Because of the large proportion of siliceous and other well-indurated rocks in the bordering mountains much of the valley alluvium consists of coarse materials that do not readily disintegrate. This coarse gravel is more or less segregated into stringers and lenses, which form the best water-bearing portions of the alluvium and rapidly yield their water to a pump.

In the building up of an alluvium-filled valley the streams abandon their old channels from time to time and form new ones. These old channels contain layers of gravel of greater or less thickness throughout all or a part of their length, and during the later filling of the valley they are buried beneath finer materials. This process is repeated over and over during the history of the valley, and thus a more or less connected series of stringers and lenses of gravel are formed at different places and at different elevations. These are so numerous that one or more of them is likely to be encountered wherever a well is bored to any considerable depth.

It appears from available data concerning the ground-water conditions, as shown on Plates VI and VII, that the true apex of the Coyote fan is somewhat farther downstream than is indicated by the topography. Logs of wells in this vicinity indicate that there is little gravel in the immediate area about the mouth of the canyon. Well No. 57 (Pl. V) is said to be about 500 feet deep, but it did not penetrate any gravel except small amounts of comparatively fine gravel, and its yield of water was so small that it was abandoned and

[1] Le Conte, Joseph, Tertiary and post-Tertiary changes of the Atlantic and Pacific coasts: Geol. Soc. America Bull., vol. 2, p. 326, 1891.

the suction of the pump run out into the river. Well No. 58 furnishes only a domestic supply of water, though it is said to be 200 or 300 feet deep. Well No. 56, an open pit about 50 feet deep, for the most part penetrated clay with a small amount of fine gravel. The writer visited this well at the time it was being dug. It is situated on what is at high water an island in Coyote River about 30 to 40 feet from the bank of the main stream. At the time of the visit the bottom of the hole was below the bed of the creek, and although there was water in the creek and the hole was not being worked it was entirely dry. The underlying materials of this area are believed to be older alluvium, perhaps of Santa Clara age. More of this older alluvium occurs farther downstream, on the east bank of the Coyote.

The average composition of the alluvium of the Morgan Hill district, as determined from well logs (see pp. 87–92), is 69 per cent clay, 29 per cent gravel, and 2 per cent sand. These figures represent the percentages of the total depth of the wells formed by the aggregate thickness of each kind of material as given in the well logs, except that the item "soil" in the logs was entirely disregarded because, for the most part, the "soil" is above the water table and has no effect on the porosity of the saturated part of the alluvium. The term "soil," as used in many of the well logs, is believed to represent angular rock fragments mixed with clay. In some places the proportion of clay is large; in others small.

POROSITY OF ALLUVIUM.

According to Buckley [1] the porosity of sandstones may be as high as 28.28 per cent by volume. King [2] gives the water capacity of undisturbed soils as 17.4 to 41.3 per cent by weight, which is equivalent to 31.3 to 49 per cent by volume. King's table is given below, with the addition of the percentage by volume, calculated from other data in the table.

Water capacity of undisturbed soils lying below the plane of saturation (water table).

Kind of soil.	Depth of layer.	Percentage of water. By weight.	Percentage of water. By volume.	Inches of water.
	Inches.			
Marly loam	0–12	41.3	49.0	5.88
Reddish clay	12–24	28.1	41.9	5.03
Do	24–36	28.4	42.2	5.07
Clay with sand	36–48	24.8	38.9	4.67
Very fine sand	48–60	17.4	31.3	3.76
				24.41

[1] Buckley, E. R., On the building and ornamental stones of Wisconsin: Wisconsin Geol. and Nat. Hist. Survey Bull. 4, Econ. ser., No. 2, pp. 402–403, 1898.

[2] King, F. H., Principles and conditions of the movements of ground water: U. S. Geol. Survey Nineteenth Ann. Rept., pt. 2, p. 70, 1899.

Base from unpublished topographic map

Ground-water data by W. O. Clark

The following table, also taken from King,[1] shows the rate of percolation of water from sand of five different degrees of coarseness, contained in cylinders 8 feet long and 5 inches in diameter:

Rate of percolation from sands under the gravitational head of the inclosed water.

Effective diameter of sand grain.	Percentage of pore space, by volume.	Weight of sand.	Amount of water percolating.			
			First 30 minutes.		Second 30 minutes.	
Millimeter.		*Pounds.*	*Pounds.*	*Inches.*	*Pounds.*	*Inches.*
0.4745	38.86	809.28	53.33	10.25	24.36	4.683
.1848	40.07	793.28	39.27	7.549	27.35	5.258
.1551	40.76	784.00	29.99	5.674	23.52	4.522
.1183	40.57	786.64	7.86	1.512	6.73	1.294
.0826	39.73	797.76	6.31	1.213	4.40	.845

According to Ries,[2] the porosity of nine different clays ranged from 17.3 to 30.1 per cent by volume.

As quoted by Robert Warington,[3] Meister gives the porosity of clay as 50 per cent, and Schwarz gives it as 52.7 per cent and that of coarse sand as 39.4 per cent.

The porosity of materials such as the alluvium under consideration does not depend on the size of the grains or particles of which it is composed, but it is influenced by a number of other factors, among the most important of which is uniformity of size of the particles. Any mixture of coarse and fine materials reduces very materially the porosity of the mass. The shape of the particles, if not decidedly angular, has little effect on porosity. The porosity of soils at and near the surface is almost always greater than that of the deeper materials largely on account of the humus contained in the surface soils.

Alluvial materials are not usually well assorted. Those of the Morgan Hill area are no exception, and their porosity is of course less than that of well-assorted materials. The average porosity of all the sands noted above is approximately 38 per cent. King, however, states that the five sands used in his percolation tests were artificially sorted. No statement is made as to whether the sand whose porosity is given by Schwarz was sorted, but from its high percentage of porosity it was probably also well assorted either artificially or by nature. The sand King gives in his table of undisturbed soils has a considerably lower porosity than any of the others. For these reasons it is believed that the average porosity of these other sands is somewhat higher than that of the sand and gravel of the Morgan Hill area, which is assumed to be about 35 per cent by volume. The average porosity of all the clays noted above is about 33 per

[1] King, F. H., op. cit., p. 91.
[2] Ries, Heinrich, Clays: their occurrence, properties, and uses, p. 163, New York, John Wiley & Sons, 1906.
[3] Warington, Robert, Physical properties of soils, p. 67, Oxford, Clarendon Press, 1900.

cent. So far as known to the writer, there was no attempt made to separate the materials of these clays and therefore this percentage may be taken to represent the porosity of the clays of the Morgan Hill area.

As stated above, about 69 per cent of the materials composing the alluvium of the Morgan Hill area is clay, about 29 per cent is gravel, and about 2 per cent is sand. From these figures the total pore space in the alluvium is computed as about 33.62 per cent of its volume.

PRECIPITATION.

The following tables give the available records of monthly and annual precipitation at Morgan Hill, in the area described in this report; at Gilroy, in the valley just south of the area described; and at Lick Observatory, on Mount Hamilton 4,209 feet above sea level, a little higher than any point draining into this section of the valley; also the available records of annual precipitation at San Francisco, San Jose, Los Gatos, and Hollister, in the region surrounding the Morgan Hill area:

Monthly and annual precipitation in inches at stations in or near the Morgan Hill area, Cal. [a]

Morgan Hill.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total for year.
1899-1900	......	......	......	......	......	......	3.07	0.56	1.70	1.66	1.14	0	....
1900-1901	0	0	0	1.03	10.82	1.22	5.82	4.91	1.12	2.30	1.05	0	28.27
1901-2	0	0	0.32	1.32	2.76	.29	1.36	9.77	5.29	2.20	0	0	23.31
1902-3	0	0	Tr.	2.34	2.38	1.81	4.92	2.53	7.20	1.95	0	0	23.13
1903-4	0	0	0	Tr.	2.90	.25	1.12	6.23	6.62	1.76	.20	Tr.	19.08
1904-5	0	0.05	2.27	1.52	.98	2.52	3.17	3.76	5.21	1.14	3.05	0	23.67
1905-6	0	0	Tr.	0	2.63	1.50	10.30	4.53	(b)	1.46	2.23	0.06	....
1906-7	0	0	Tr.	0	1.93	10.17	7.98	1.70	10.10	.43	.20	.73	33.24
1907-8	0	(b)	.02	2.12	.19	6.62	3.28	2.39	1.48	.13	.90	0	17.13
1908-9	0	0	Tr.	0	1.31	1.74	13.50	7.38	4.30	0	Tr.	Tr.	28.23
1909-10	0	0	.17	(b)	1.40	5.83	5.34	1.20	3.15	.42	0	Tr.	....
1910-11	Tr.	0	.23	.80	.30	1.03	12.80	1.65	8.35	1.15	.23	.12	26.66
1911-12	Tr.	0	0	.66	.22	2.29	3.32	.25	4.11	3.37	1.00	.23	15.45
1912-13	0	0	.75	Tr.	.84	.68	5.19	.09	1.82	.26	.58	.15	10.36
1913-14	0.35	.15	0	Tr.	4.52	5.88	18.94	5.78	1.05	.90	0	.12	37.69
1914-15	0	0	0	.78	.44	6.98	5.29	9.22	1.49	.91	1.84	0	26.95
1915-16	0	0	0	0	.58	6.07	14.69	2.14	1.71	......	......	......	....
Mean	.02	.01	.24	.71	2.14	3.43	7.06	3.78	4.04	1.25	.78	.09	23.55

a Unpublished records of U. S. Weather Bureau. b No record.

Monthly and annual precipitation in inches at stations in or near the Morgan Hill area, Cal.—Continued.

Gilroy.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total for year.
1874	......	......	......	......	......	......	5.22	2.04	3.15	0.95	0.16	......	....
1874–75	0	0	......	3.55	2.09	0.04	7.70	.75	.69	......	......	0.30	15.12
1875–76	0	0	......	......	11.75	1.88	6.75	3.97	5.93	.76	......	......	31.04
1876–77	0	......	......	1.25	......	......	3.75	......	.82	.27	.44	......	6.53
1877–78	0	......	......	.10	1.14	1.56	8.89	11.48	3.24	1.62	......	......	28.03
1878–79	0	......	......	.88	.70	.42	3.80	4.02	3.98	1.47	1.34	.15	16.76
1879–80	0	......	......	1.00	1.68	3.63	2.36	1.74	1.84	9.48	.65	......	22.38
1880–81	0	......	......	......	.46	12.33	6.84	1.95	1.14	.59	......	.11	23.42
1881–82	0	......	0.34	.46	.81	2.35	1.28	2.17	5.61	.72	.25	.10	14.09
1882–83	0	......	1.46	2.22	1.64	.38	2.28	1.02	2.77	1.19	2.23	......	15.19
1883–84	0	......	.27	1.01	.33	.78	2.94	6.65	7.24	3.80	.34	1.24	24.60
1884–85	0	......	.12	1.73	.06	8.83	2.03	.09	.28	1.48	......	.12	14.74
1885–86	0.05	0.11	......	......	6.77	2.40	6.09	.32	1.17	4.32	.22	......	21.45
1886–87	......	......	......	.78	.33	1.09	.90	5.14	.82	2.05	......	......	11.11
1887–88	......	......	.43	......	1.15	4.32	5.35	.77	3.92	.40	.44	......	16.78
1888–89	......	......	.32	......	3.71	2.10	.46	1.00	4.22	.63	2.00	......	14.44
1889–90	......	......	......	5.36	2.98	10.21	10.50	5.62	1.89	.64	.55	......	37.75
1890–91	......	......	.20	......	.10	3.84	.75	6.76	.97	2.18	.04	......	14.84
1891–92	......	......	.03	.07	.11	5.80	4.71	1.90	4.18	.90	1.21	......	18.91
1892–93	......	......	......	1.19	5.40	3.99	3.11	4.34	4.80	1.35	.32	......	24.50
1893–94	......	......	.06	.02	.72	1.87	4.71	3.04	.66	.55	1.28	......	12.91
1894–95	......	......	1.04	1.26	.24	8.44	10.39	1.79	2.54	1.90	1.21	......	28.81
1895–96	......	......	......	1.27	1.04	1.91	10.06	......	2.06	4.02	4.34	......	24.70
1896–97	......	1.00	.09	1.88	3.75	1.99	2.05	4.97	5.53	.45	.02	.09	21.82
1897–98	......	......	.05	1.94	.35	1.93	.98	2.27	1.24	.32	1.28	.08	10.44
1898–99	......	......	.15	.40	.33	.93	6.00	.32	9.80	.51	1.00	......	19.44
1899–1900	......	......	......	2.40	3.09	2.79	2.22	.34	1.65	1.60	.45	......	14.54
1900–1901	......	......	.01	1.59	9.29	.99	2.44	3.95	1.29	2.07	1.54	......	23.17
1901–2	......	......	.15	.86	1.96	.29	1.16	8.28	3.61	1.83	.27	......	18.41
1902–3	......	......	......	1.43	1.85	1.27	3.31	1.97	6.44	1.21	......	......	17.48
1903–4	......	......	......	......	2.95	.28	1.03	6.40	5.94	1.66	......	......	18.26
1904–5	......	......	2.01	2.07	.76	1.92	3.54	4.39	4.84	.79	2.93	......	23.25
1905–6	......	......	......	......	1.90	1.40	11.35	3.46	7.77	1.27	2.21	.06	29.42
1906–7	......	......	......	......	2.29	10.26	3.46	1.73	10.24	.41	.12	.47	28.98
1907–8	......	......	......	1.80	......	5.44	2.83	1.97	1.24	.45	.52	......	14.25
1908–9	......	......	.02	.25	1.93	1.95	12.80	6.41	4.41	......	......	.04	27.81
1909–10	......	......	.16	.54	2.00	6.33	5.79	1.18	3.07	......	......	......	....
1910–11	......	......	.05	.54	.44	.97	6.63	2.19	6.19	1.99	.34	.07	19.41
1911–12	......	......	......	.58	.64	2.04	2.68	.17	4.00	2.89	.84	.03	....
1912–13	......	......	.71	.20	.30	.51	4.68	.05	2.18	.23	.83	.06	9.75
1913–14	.66	.08	......	......	3.28	10.12	14.64	2.81	.95	1.05	.05	.06	33.70
1914–15	......	......	......	.70	.52	5.41	4.84	5.65	1.34	1.19	1.57	......	21.22
1915–16	......	......	Tr.	......	.52	5.01	12.68	.80	1.83	0	......	......	....
Mean	.02	.03	.18	.94	1.94	3.33	5.02	2.93	3.43	1.46	.74	.71	20.73

Monthly and annual precipitation in inches at stations in or near the Morgan Hill area, Cal.—Continued.

Lick Observatory.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total for year.
1881							3.51	5.99	1.13	0.98	0.09	0.33	
1881–82	0	0	0.10	0.33	0.91	9.72	3.55	2.90	5.40	4.70	.48	1.06	29.15
1882–83	0	0	0	6.16	3.45	1.93	3.10	3.75	8.66	2.66	7.55	0	37.26
1883–84	0	0	.65	2.15	1.48	2.05	5.60	12.76	16.35	1.24	3.85	3.85	58.09
1884–85	0	0.15	.65	3.71	.01	33.84	1.99	.57	1.15	2.08	.16	.36	44.67
1885–86	0	0	.15	.05	1.92	9.80	4.44	1.80	5.77	6.79	.70	0	31.42
1886–87	0	0	0	.60	2.82	2.34	2.83	7.80	1.39	5.75	.25	.30	24.08
1887–88	0.04	0	.33	09	0.90	11.25	10.04	1.38	3.40	.68	1.25	.67	30.03
1888–89	0	.02	.49	.03	3.27	4.23	1.04	1.42	6.17	1.92	3.21	.05	21.85
1889–90	0	0	0	4.38	4.46	13.19	7.93	6.60	4.39	1.79	2.42	0	45.16
1890–91	0	0	.80	.02	.58	5.39	1.38	7.12	4.10	3.08	1.01	.57	24.05
1891–92	0	0	.28	.61	.38	9.54	1.97	2.99	5.98	1.90	3.52	.32	27.49
1892–93	0	Tr.	.24	1.38	10.30	5.56	3.29	3.45	8.99	3.61	.95	.16	37.93
1893–94	0	0	.48	.66	4.01	3.58	9.74	10.52	2.54	.89	2.78	.64	35.84
1894–95	.02	Tr.	1.64	2.98	.84	11.90	10.00	3.08	1.46	2.30	2.39	0	36.61
1895–96	.01	0	.08	.78	2.46	3.16	9.54	1.08	3.83	6.70	2.10	.02	29.76
1896–97	Tr.	.28	.47	1.85	5.86	4.91	3.50	7.42	6.45	.82	.28	.38	32.22
1897–98	0	0	.07	1.25	1.51	2.70	2.30	4.16	2.04	.84	2.41	.38	17.66
1898–99	0	0	.29	1.33	1.23	2.13	5.63	.75	11.11	1.40	1.47	.39	25.73
1899–1900	0	.12	Tr.	6.37	4.92	4.16	3.26	1.70	3.37	4.06	1.35	Tr.	29.31
1900–1901	.01	.02	.08	3.48	7.76	2.21	5.76	5.92	1.98	3.33	1.07	.02	31.64
1901–2	0	.05	1.08	2.19	2.89	1.61	1.44	9.42	5.19	2.61	1.14	0	27.62
1902–3	0	0	0	2.05	3.01	3.11	8.86	2.20	9.89	1.12	.05	Tr.	30.29
1903–4	0	0	Tr.	.29	7.67	1.39	1.98	9.53	8.06	4.28	.45	.03	33.78
1904–5	Tr.	.05	2.33	2.51	2.05	3.84	4.04	4.19	5.91	1.36	2.27	0	28.55
1905–6	0	0	.02	0	3.00	2.04	11.66	5.76	9.82	1.83	3.15	1.15	38.43
1906–7	0	Tr.	.28	.05	1.92	10.31	9.74	4.76	13.80	1.14	.42	.92	43.34
1907–8	Tr.	0	.01	1.62	.18	7.77	5.02	4.26	1.95	.70	2.39	.02	23.92
1908–9	0	0	0	0	2.63	2.96	18.18	9.49	4.05	0	.11	0	37.42
1909–10	0	0	0	1.77	2.59	6.87	7.29	3.12	3.28	.91	.12	.07	26.02
1910–11	.04	0	.25	1.06	.94	1.77	15.76	4.37	7.00	1.35	.75	0	33.29
1911–12	0	0	0	.46	1.21	3.22	4.44	.50	3.96	3.70	1.31	.44	18.24
1912–13	0	0	2.01	.94	2.34	2.28	5.42	.48	3.40	.94		.07	17.88
1913–14	.06	.10	0	0	5.34	6.05	11.57	5.24	2.31	2.01	1.80	1.13	35.61
1914–15	0	0	Tr.	1.39	.74	6.55	8.93	1.33	2.01	2.16	4.64	0	27.75
1915–16	0	Tr.	.01	0	1.13	5.56	14.67	4.05	2.96	.47			
Mean	.01	.02	.37	1.50	2.84	5.97	6.37	4.49	5.26	2.56	1.57	.37	31.33

Annual precipitation in inches at stations near the Morgan Hill area, Cal.

Year.	San Francisco.	San Jose.	Los Gatos.	Hollister.	Year.	San Francisco.	San Jose.	Los Gatos.	Hollister.
1849–50	33.10				1883–84	32.38	20.08		16.54
1850–51	7.42				1884–85	18.10	11.27		6.95
1851–52	18.46				1885–86	33.05	20.63	43.02	14.44
1852–53	35.26				1886–87	19.04	11.36	24.36	7.47
1853–54	23.87				1887–88	16.74	12.17	24.17	10.12
1854–55	23.76				1888–89	23.86	15.71	29.87	12.81
1855–56	21.66				1889–90	45.85	30.30	67.22	22.48
1856–57	19.91				1890–91	17.58	12.88	31.97	10.10
1857–58	21.81				1891–92	18.53	16.51	23.11	11.58
1858–59	22.22				1892–93	21.75	25.17	56.24	17.42
1859–60	22.27				1893–94	18.47	12.92	21.25	12.01
1860–61	19.72				1894–95	25.70	23.32	47.18	18.53
1861–62	49.27				1895–96	21.25	13.69	34.48	14.06
1862–63	13.74				1896–97	23.43	16.56	32.49	14.04
1863–64	10.08				1897–98	9.38	6.87	15.18	7.15
1864–65	24.73				1898–99	16.87	10.02	24.93	9.88
1865–66	22.93				1899–1900	18.47	13.87	24.24	10.92
1866–67	34.92				1900–1901	21.17	19.88	41.35	15.76
1867–68	38.84				1901–2	18.98	12.98	33.23	11.47
1868–69	21.35				1902–3	18.28	13.89	28.98	12.64
1869–70	19.31				1903–4	20.59	10.47	29.25	11.79
1870–71	14.11				1904–5	23.45	17.96	35.88	17.24
1871–72	30.87				1905–6	20.42	15.12	38.13	20.45
1872–73	15.66				1906–7	26.17	22.71	43.42	23.80
1873–74	24.73				1907–8	17.35	11.69	22.38	10.94
1874–75	20.56	7.90		9.37	1908–9	25.57	18.31	44.75	17.63
1875–76	31.19	19.47		15.57	1909–10	19.52	14.52	25.78	14.67
1876–77	11.04	4.83		4.69	1910–11	25.67	22.65	52.64	13.39
1877–78	35.18	19.28		18.12	1911–12	14.06	10.58	19.46	10.06
1878–79	24.44	16.40		8.81	1912–13	11.97	6.35	15.53	6.73
1879–80	26.66	13.77		12.38	1913–14	29.60	19.45	52.98	19.85
1880–81	29.86	12.45		12.48	1914–15	27.41	22.71	36.81	18.20
1881–82	16.14	11.75		10.44					
1882–83	20.12	10.59		9.62	Mean	22.63	15.41	33.10	13.26

According to the available records, the average annual precipitation is 24.09 inches at Morgan Hill, 22.96 inches at San Francisco, 14.42 inches at San Jose, 20.15 inches at Gilroy, 13.07 inches at Hollister, and 32.62 inches at Lick Observatory.[1] From San Francisco southward to San Jose the precipitation decreases about as the distance from San Francisco increases. From San Jose southward it increases to an apparent maximum about Morgan Hill and again falls off toward Hollister.

The rainfall of the region is confined largely to the season from October to April, inclusive, during which, in the years covered by the records, the rainfall at San Francisco amounted to 90 per cent of the total for the year, at San Jose 88 per cent, at Lick Observatory 87 per cent, at Los Gatos 89 per cent, at Morgan Hill 92 per cent, at Gilroy 89 per cent, and at Hollister 90 per cent. In some years the rainfall within these six months is very unevenly distributed. Occasionally there are heavy downpours, especially in the mountain areas. Two such downpours occurred during January, 1911,[2] in one of which 9.19 inches fell within 24 hours and in the other 5.56 inches.

STREAM FLOW.

The following table gives the monthly and annual discharge of Coyote River at the wagon bridge near the mouth of the canyon, about 2½ miles east of Madrone.[3] The last column, added by the writer, shows the average of the precipitation at Lick Observatory and that at Gilroy, which is believed to represent approximately the average precipitation on the mountain area of the Coyote River drainage basin. The second table shows the absorption by the alluvium along Coyote River between the upper gorge east of Madrone and the lower gorge near Coyote station.

Monthly discharge of Coyote River near Madrone, Cal., and average of precipitation at Lick Observatory and Gilroy for 1902–1914.

[Drainage area, 193.2 square miles.]

Month.	Discharge in second-feet.				Run-off.		Precipitation, in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	Total in acre-feet.	Depth in inches on drainage area.	
1902–3.							
October			0.75	0.0039	46	0.004	1.74
November			1.93	.010	115	.01	2.43
December			2.61	.014	160	.02	2.19
January			290	1.50	17,800	1.73	5.70
February			153	.793	8,500	.83	2.08
March			490	2.54	30,100	2.93	8.16
April			400	2.07	23,800	2.31	1.16
May			20.4	.106	1,250	.12	.02
June			11.4	.059	678	.07	T.
July			7.42	.038	456	.04	0
August			4.92	.026	303	.03	0
September			.66	.0034	39	.004	T.
The year			115	.596	83,200	8.10	25.18

[1] U. S. Weather Bur. Bull. W, sec. 14, 1912.

[2] U. S. Weather Bur. Monthly Weather Review, January, 1911, p. 125.

[3] McGlashan, H. D., and Stevens, G. C., Surface water supply of the United States, 1912, Part XI, Pacific coast basins in California: U. S. Geol. Survey Water-Supply Paper 331, pp. 107-109, 1914.

Monthly discharge of Coyote River near Madrone, Cal., and average of precipitation at Lick Observatory and Gilroy for 1902–1914—Continued.

Month.	Discharge in second-feet.				Run-off.		Precipitation, in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	Total in acre-feet.	Depth in inches on drainage area.	
1903–4.							
October			0.60	0.0031	37	0.004	0.14
November			1.20	.0062	71	.007	5.31
December			1.29	.0067	79	.008	1.13
January			2.12	.011	130	.01	1.50
February			105	.544	6,040	.59	7.96
March			384	1.99	23,600	2.29	7.00
April			67.8	.351	4,030	.39	3.02
May			17.7	.092	1,090	.11	.22
June			6.16	.032	367	.04	.01
July			2.47	.013	152	.02	T.
August			.81	.0042	50	.005	.02
September			1.78	.014	165	.02	2.17
The year			49.3	.255	35,800	3.49	28.48
1904–5.							
October			2.73	.014	168	.02	2.29
November			3.20	.017	190	.02	1.45
December			1.09	.0056	67	.006	2.88
January	42		9.77	.051	601	.06	3.79
February	1,510		165	.855	9,160	.89	4.29
March	3,000		252	1.31	15,500	1.51	5.37
April	86		35.5	.184	2,110	.21	1.07
May	363		48.0	.249	2,950	.29	2.60
June			10.8	.056	643	.06	0
July			4.18	.022	257	.03	0
August			1.82	.0094	112	.01	0
September			.61	.0032	36	.004	.01
The year			44.6	.231	31,800	3.11	23.75
1905–6.							
October			.43	.0022	26	.003	0
November			.92	.0048	55	.005	2.45
December			1.49	.0077	92	.009	1.72
January	8,350	1.8	539	2.79	33,100	3.22	11.51
February	1,080	30	235	1.22	13,100	1.27	4.61
March	5,750	130	778	4.03	47,800	4.65	8.79
April	1,550	102	235	1.22	14,000	1.36	2.55
May	95	56	73.1	.379	4,490	.44	2.68
June	71	24	38.5	.199	2,290	.22	.60
July			14.4	.075	885	.09	0
August			6.68	.035	411	.04	T.
September			4.48	.023	726	.03	.14
The year			161	.834	117,000	11.34	35.05
1906–7.							
October			3.18	0.016	196	0.02	0.02
November	25	4.9	6.92	.036	412	.04	2.10
December	8,210	6.5	372	1.93	22,900	2.22	10.28
January	2,850	175	932	4.83	57,300	5.57	6.60
February	1,810	130	326	1.69	18,100	1.76	3.24
March	8,200	158	1,380	7.15	84,800	8.24	12.02
April	560	98	217	1.12	12,900	1.25	.77
May	98	37	61.9	.321	3,810	.37	.27
June	47	19	29.5	.153	1,760	.17	.69
July	19	12	13.2	.068	812	.08	.0
August			8.32	.043	512	.05	.0
September			4.97	.026	296	.03	T.
The year			280	1.45	204,000	19.80	35.99

Monthly discharge of Coyote River near Madrone, Cal., and average of precipitation at Lick Observatory and Gilroy for 1902–1914—Continued.

Month.	Discharge in second-feet.				Run-off.		Precipitation, in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	Total in acre-feet.	Depth in inches on drainage area.	
1907–8.							
October	4.4	4.1	4.3	0.022	264	0.03	1.71
November	41	4.4	14.4	.075	857	.08	.09
December	1,970	20	120	.622	7,380	.72	6.60
January	2,150	30	195	1.01	12,000	1.16	3.92
February	1,280	47	234	1.21	13,500	1.30	3.11
March	690	38	156	.808	9,590	.93	1.59
April	40	18	27.4	.142	1,630	.16	.55
May	22	12	14.7	.076	904	.09	1.45
June	12	6	8.82	.046	525	.05	.01
July	6	2	4.7	.024	289	.03	.0
August	3	2	2.33	.012	143	.01	.0
September	2.2	1.5	1.90	.0098	113	.01	.01
The year	2,150	1.5	65.3	.338	47,200	4.57	19.04
1908–9.							
October	2	1.2	1.82	.0094	112	.01	0.12
November	3.7	1.9	2.19	.011	130	.01	2.28
December	3.9	2.1	3.07	.016	189	.02	2.45
January	a 8,230	a 3.5	1,100	5.70	67,600	6.57	15.49
February	a 7,040	a 209	1,260	6.53	70,000	6.80	7.90
March	1,580	a 91	346	1.79	21,300	2.06	4.23
April	510	70	173	.896	10,300	1.00	0
May	68	a 39	48.9	.253	3,010	.29	.05
June	38	21	28.6	.148	1,700	.17	.02
July	20	12	15.6	.081	959	.09	0
August	12	9	11.2	.058	689	.07	0
September	12	9	9.9	.051	589	.06	.08
The year	a 8,230	1.2	250	1.30	176,000	17.15	32.62
1909–10.							
October	12.5	9	10.7	.055	658	.06	1.15
November	17	10.5	12.0	.062	714	.07	2.79
December	3,000	12	105	.544	646	.63	6.60
January	2,120	52	355	1.84	21,800	2.12	7.54
February	680	52	129	.668	7,160	.70	2.15
March	680	38	139	.720	8,550	.83	3.17
April	156	25	59.7	.309	3,550	.34	.91
May	28	8.5	17.6	.091	1,080	.10	.06
June	9	5.5	7.7	.040	458	.04	.03
July	5.5	4	4.6	.024	283	.03	.02
August	4	2.5	3.3	.017	203	.02	0
September	4	2.5	3.1	.016	184	.02	.15
The year	3,000	2.5	70.6	.366	45,300	4.96	24.57
1910–11.							
October	5	2.5	3.4	.018	209	.02	.80
November	4	3	3.6	.019	214	.02	.69
December	5	3.5	4.6	.024	283	.03	1.37
January	4,400	4.5	524	2.72	32,200	3.14	11.15
February	1,160	50	292	1.51	16,200	1.57	3.28
March	25,000	90	1,190	6.17	73,200	7.11	6.59
April	190	13.5	45.1	.234	2,680	.26	1.72
May	12.5	4.5	7.0	.036	430	.04	.54
June	4.5	3	3.9	.020	232	.02	.03
July	3	2	2.5	.013	154	.02	0
August	2	1.5	1.8	.0093	111	.01	0
September	1.5	1.5	1.5	.0078	89	.009	....
The year	25,000	1.5	173	.896	126,000	12.25	26.17

a From automatic-gage record.

Monthly discharge of Coyote River near Madrone, Cal., and average of precipitation at Lick Observatory and Gilroy for 1902–1914—Continued.

Month.	Discharge in second-feet.				Run-off.		Precipitation, in inches.
	Maximum.	Minimum.	Mean.	Per square mile.	Total in acre-feet.	Depth in inches on drainage area.	
1911–12.							
October	2	1.5	1.6	0.0083	98	0.01	0.52
November	2	1.5	1.8	.0093	107	.01	.92
December	2.5	1.5	1.8	.0093	111	.01	2.63
January	5.5	1.5	2.9	.015	178	.02	3.56
February	4.5	2.5	3.2	.017	184	.02	.33
March	1,210	2.5	59.4	.308	3,650	.36	3.98
April	283	3	23.4	.121	1,390	.14	3.35
May	4.5	3	3.6	.019	221	.02	2.10
June	3	2.5	2.8	.014	167	.02	.64
July	2.5	1.5	1.9	.0098	117	.01	.01
August	1.5	1.0	1.4	.0072	86	.008	0
September	2.5	1.0	1.2	.0062	71	.07	1.00
The year	1,210	1.0	8.75	.045	6,380	.70	19.04
1912–13.[a]							
October					8	.001	.57
November					46	.01	1.32
December					39	.004	1.39
January					1,989	.19	5.05
February					466	.05	.26
March					467	.05	2.79
April					466	.05	.58
May					234	.02	1.21
June					87	.01	.06
July					4	.0004	.36
August					0	0	.09
September					23	.002	0
The year					3,829	.37	13.67
1913–14.							
October					0	0	0
November					8	.001	4.31
December					8,148	.79	8.08
January					106,352	10.32	13.10
February					59,102	5.74	4.02
March					10,949	1.06	1.63
April					2,373	.23	1.53
May					1,033	.10	.92
June					697	.06	.59
July					424	.04	0
August					278	.03	0
September					0	0	T.
The year					189,364	18.38	34.18

[a] Data from records of Bay Cities Water Co.

NOTE.—Mean monthly discharge computed by Duryea, Haehl & Gilman. Maximum and minimum discharges given in the table taken from the compiled or original data and represent highest and lowest computed discharges. Other run-off values computed by engineers of the United States Geological Survey.

Measured absorption by the alluvium between the upper and the lower gorges of Coyote River.[a]

[Authority, Bay Cities Water Co.]

Year.	Discharge.		Absorption between upper and lower gorges.	Recharge of ground water.[b]	Discharge at upper gorge absorbed by alluvium between upper and lower gorges.	Depth on drainage area absorbed by alluvium between upper and lower gorges.
	Upper gorge.	Lower gorge.				
	Million cubic feet.	*Million cubic feet.*	*Million cubic feet.*	*Acre-feet.*	*Per cent.*	*Inches.*
1903–4	1,588	1,103.3	484.7	11,127	30.5	1.08
1904–5	1,392	694.6	697.4	16,010	50.1	1.55
1905–6	5,064.8	4,178.5	886.3	20,346	17.5	1.97
1906–7	8,883.6	7,314.5	1,569.1	36,021	17.7	3.49

[a] No. 15194, Superior Court of Santa Clara County, Cal. Opening brief for defendants Hayes-Chenoweth Co. (a corporation) et al., plaintiffs, *v.* Bay Cities Water Co. (a corporation) et al., defendants, Appendix, pp. v, xii.

[b] Calculated by the writer.

The following table shows the annual precipitation and run-off from the mountain area of the Coyote drainage basin from 1902 to 1912, both expressed in inches of depth over the entire basin. It also shows the percentage of the precipitation that was discharged each year during the period. (See also fig. 7.)

Relation between precipitation and run-off for the mountain drainage of Coyote River.

Year (Oct. 1 to Sept. 30).	Precipitation on mountain area of Coyote River basin (average of Lick Observatory and Gilroy).	Run-off from mountain area of Coyote River basin expressed in depth on drainage area.	Ratio of run-off to precipitation.
	Inches.	*Inches.*	*Per cent.*
1902–3	23.88	8.10	33.92
1903–4	26.02	3.49	13.41
1904–5	25.90	3.11	12.01
1905–6	33.92	11.34	33.43
1906–7	36.16	19.80	54.76
1907–8	19.08	4.57	23.95
1908–9	33.61	17.15	52.59
1909–10	22.85	4.96	21.79
1910–11	26.35	12.25	46.49
1911–12	16.05	.70	4.36
Mean	26.28	8.55	32.52

That there is no constant relation between precipitation and discharge is shown by the records given in the preceding tables and also by the daily records of the United States Weather Bureau and the United States Geological Survey, not published in this report. This absence of a constant relation is also shown by figures 7 and 8. The records show, however, that there is a general tendency for the percentage of precipitation discharged by Coyote River to increase with increasing precipitation. Thus in the two years that the precipitation was less than 20 inches the run-off amounted to only 14 per cent of the precipitation

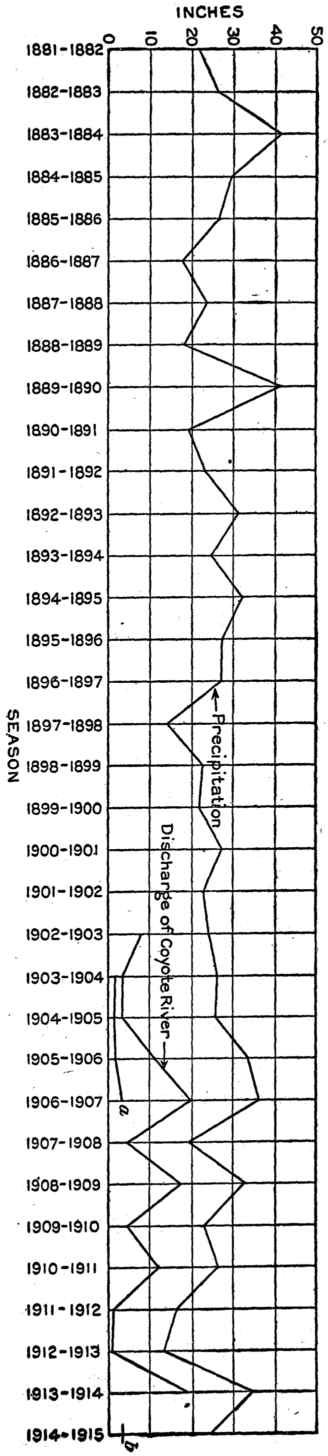


FIGURE 7.—Diagram showing precipitation on, run-off from, and ground-water recharge from mountain area of drainage basin of Coyote River, Morgan Hill area, Cal., expressed in inches on this area in each year for which records are available. *a*, Ground-water recharge between upper and lower gorges, based on measured losses in stream flow; *b*, ground-water recharge in Morgan Hill area, based on measured rise of water table.

on the drainage area; in the five years that the precipitation was between 20 and 30 inches the run-off amounted to about 26 per cent; and in the three years that the precipitation was between 30 and 40 inches the run-off amounted to about 47 per cent.

Because the rainfall is practically confined to one-half of the year, because it is frequently very rapid, especially in the mountainous districts, and because the mountains are rugged and relatively barren, especially on the east side of the valley, the streams are very erratic in their flow. This is particularly true of Coyote River, which has a much larger drainage basin and discharges much more water than any other stream entering the Morgan Hill area. The

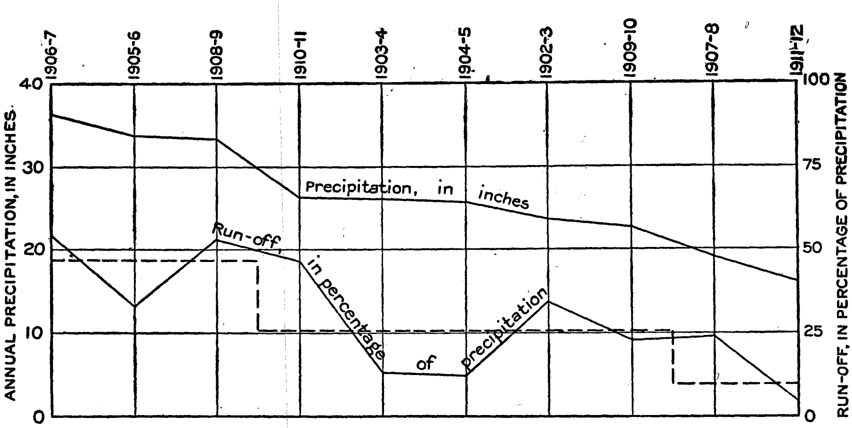


FIGURE 8.—Diagram showing relation between amount of precipitation on the mountain area of the Coyote River drainage basin, Cal., and percentage of run-off therefrom. Broken line gives average percentage for years having respectively more than 30 inches, between 20 and 30 inches, and less than 20 inches of precipitation.

erratic character of the flow of Coyote River may be seen from the records of the daily discharge.[1] On January 11, 1906, the discharge was 1.4 second-feet, and on the next day it was 1,460 second-feet; on March 22 of the same year it was 275 second-feet, and on the next day it was 2,090 second-feet. On January 12, 1909, it was 98 second-feet, and on January 13 it was 1,980 second-feet; on February 10 of the same year the discharge was 931 second-feet, and on February 11 it was 4,820 second-feet.

OCCURRENCE OF GROUND WATER.

In the Morgan Hill area the ground water occurs in the valley alluvium. Over most of the valley area here considered the water table, or surface below which the alluvium is saturated, lies at a depth of about 20 to 80 feet below the surface of the ground during the

[1] U. S. Geol. Survey Water-Supply Paper 331, pp. 102-106, 1914.

low-water season and about 15 to 50 feet during the high-water season. (See Pls. VI and VII and table on pp. 92–105.) The water occurs in the interstices of the alluvium below the water table, and most of the water available for irrigation is found in the gravels and coarser parts of the alluvium. There may be large quantities of water in the finer materials, but these materials permanently retain a large percentage of their water content and give up only very slowly the small part which they may finally yield. The available supply of ground water is therefore confined largely to the more porous portions of the alluvium.

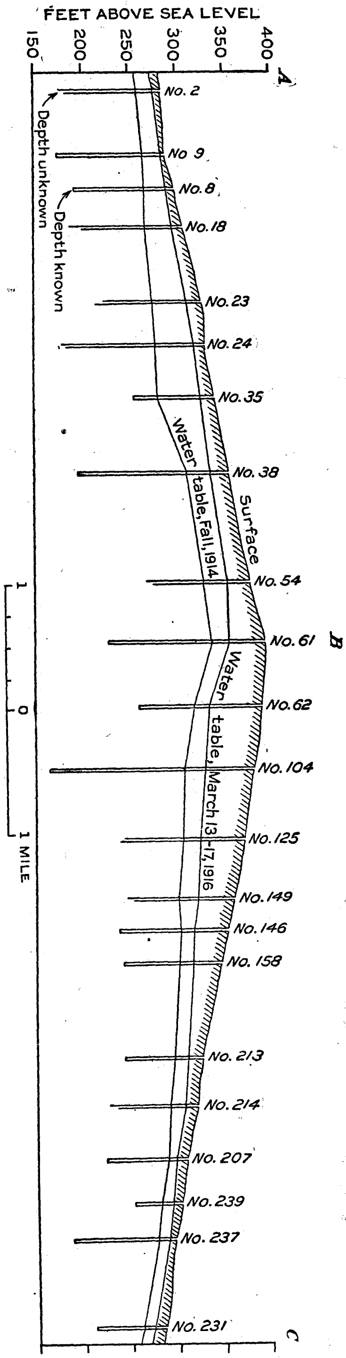


FIGURE 9.—Profiles of surface and water table along line *A B C* shown in Plates VI and VII. Wells whose depth is unknown are indicated by unfinished lines at bottom.

SHAPE OF WATER TABLE.

The shape of the water table at different seasons of the year is shown in contours on the two large maps (Pls. VI and VII) and by the profiles shown in figure 9. The water contours on Plate II show that the ground-water divide during the low-water stage is in general near the surface-water divide, although in the neighborhood of Coyote River it is somewhat farther north than the surface-water divide. The highest point in the water table for the low-water season appears to be about where Cochran Road forks, one branch continuing down Coyote River and the other striking off toward Madrone. The crest of the ground-water divide roughly parallels Cochran Road but is about half a mile south of it. South of this divide at the low-water stage the ground water has a southeasterly slope of somewhat less than 6 feet to a mile for a distance of about 3½ miles, beyond which the slope quickly increases to about 12 feet to a mile. North of the divide the slope is about 12 feet to a mile in a northwesterly direction. The highest part of the water table, as shown by the contours on both Plates VI and VII, is near the mouth of the canyon of Coyote River, showing that this river is the principal source of the ground water. The contours on Plate VI for the area below the mouth of the canyon show that water is passing from the river into the alluvium all along its course as far northward as the limit of the area mapped. At the high-water stage the ground-water divide is a mile or so farther north than it is at the low-water stage, the northerly slope is about 18 feet to a mile, and the southerly slope for the first 4 miles is about 8 feet to a mile, and beyond that about 20 feet to a mile. The part of the water table that has the least slope at both stages extends northeast and southeast of Morgan Hill. Both profiles in figure 9 show that the water table reaches its greatest elevation in the vicinity of well 61 and slopes away from this well in both northerly and southerly directions.

FLUCTUATIONS OF WATER TABLE.

The annual fluctuation of the water table in the Morgan Hill area is large, ranging from about 10 to 45 feet. The lowest water occurs about December and the highest about March or April. The exact time of these maximum stages varies, depending on the rainfall. The amount of fluctuation also varies from year to year, depending on the distribution as well as the amount of rainfall. In years when the rainfall is largely concentrated into one or two months the run-off may be large but the recharge of ground water small, while in years when the rainfall is evenly distributed through six or seven months the run-off may be only normal but the rise of ground water may be considerably above normal.

The fluctuations shown on Plate VII are those that occurred between the fall of 1914 and March, 1916. This fluctuation is slightly greater than the annual fluctuation for the season of 1914–15. The data given in the table on pages 92–105 and figure 10 indicate that in March, 1916, the water table did not stand in general more than a foot higher than its greatest elevation in 1915, and later calculations are based on this assumption. Over an area of 11,130 acres (determined by planimeter) the fluctuation was from 10 to 20 feet (Pl. VII); over an area of 3,100 acres the fluctuation was from 20 to 30 feet; and over an area of 1,500 acres the fluctuation was more than 30 feet.

SOURCE OF GROUND WATER.

There are two sources of ground water in the Morgan Hill area. First in importance is the water percolating from streams, and second is the rainfall upon the valley, which soaks into the ground and finally joins the body of ground water, especially in those areas where the soil is very porous. It is said that in certain parts of the area there is no run-off, even after the hardest rains, all the water being immediately absorbed.

About 92 per cent of the rainfall at Morgan Hill occurs in the months from November to April, inclusive, and according to Duryea's estimate[1] the annual evaporation is about 56.7 inches, only about

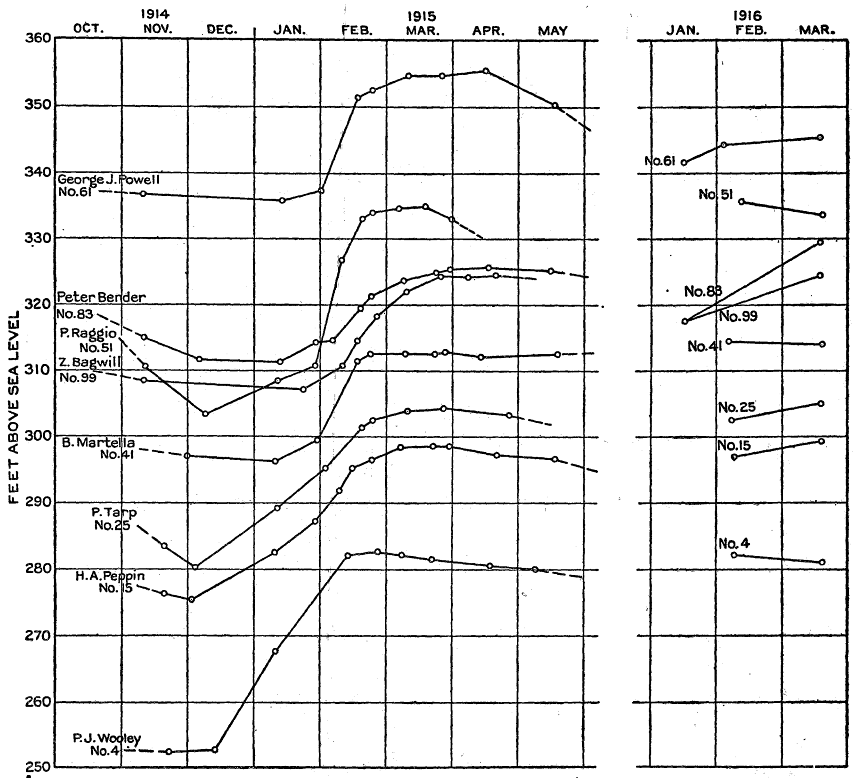


FIGURE 10.—Diagram showing fluctuations of water levels in wells in Morgan Hill area, Cal.

22 per cent of which occurs during this period. Duryea's estimates are based on the mean of the monthly means of groups of evaporating pans placed near the mouth of the canyon of Coyote River and at Laguna Seca, in the valley only a mile or two north of the area covered by this investigation. It is very fortunate for the Morgan Hill area, as it is for the whole of Santa Clara Valley, that most of the rainfall occurs during the season when evaporation is at its minimum. This means that a much larger percentage of the rainfall soaks into the ground than would otherwise be the case. But even under these favorable conditions a relatively small portion of the precipitation

[1] Duryea, Edwin, jr., California evaporation records: Eng. News, vol. 67, p. 382, Feb. 29, 1912.

on the valley floor reaches the ground water, most of which is derived from percolation from streams flowing over the alluvium. Fortunately there is a large amount of coarse material along the streams, particularly where the streams emerge from the mountains, and the fact that this mass of exceptionally coarse material is connected with numerous lenses and stringers of gravel very much facilitates the replenishment of the ground water.

Coyote River is the main source of supply for the area under consideration, except in the southern part, as is clearly shown by the contours of the water table on Plates VI and VII and by the facts that the highest portion of the water table lies along the creek, especially at the high-water stage, and the fluctuation of the water table is also greatest in the area near the river, as is also shown by figure 8. The southern part of the area receives the major portion of its ground water from Llagas Creek and Coyote River.

In general the conditions shown by the water contours on Plates VI and VII are the same, but the ground-water divide is about a mile farther northwest at the high-water stage, as shown on Plate VII. This shifting of the ground-water divide is probably to be accounted for by the fact that the apex of the deeper portion of the Coyote fan is probably some distance downstream from the mouth of the present canyon. It is to be expected that the most rapid percolation from the stream would occur in the portion of the fan in which there is the greatest abundance of coarse materials, and this portion should be found at the position of the apex of the fan during the time of its greatest upbuilding.

MOVEMENT OF GROUND WATER.

Ground water, like surface water, runs downhill—that is, it moves down the slope of the water table. Hence, the general direction of movement south of the ground-water divide is southward and southeastward. This area embraces, roughly, two-thirds of the proposed irrigation district. North of this divide the ground water moves in a northwesterly direction, especially during the low-water period. During the period of rising ground water the direction of movement in this locality is more nearly westward, because the river is the source of the ground water, and the water table is higher in this area—that is, the ground water must move away from its source toward the point of discharge. The ground water comes nearer and nearer to the surface in a northwesterly direction until it forms a swampy area along Bailey Avenue about a mile north of the area covered by this report. This swampy area drains back into Coyote River through Laguna Seca, which derives most of the water found in the lower portion of its course from ground waters that were originally lost from Coyote River farther upstream, the water being brought to the surface in the vicinity of Laguna Seca by a mass of solid rock which cuts almost entirely across the valley near Coyote station.

Both the contours of the water table shown on Plates VI and VII and the profiles of the water table shown in figure 9 indicate that the water from Coyote River percolates indefinitely southward through the alluvium, mingling with waters from Llagas Creek and other streams that enter that part of the valley. This condition indicates that the gravel channels formed by the Coyote in the past extend southward through this region.

PUMPING TESTS.

Only three wells within the proposed irrigation district are used for irrigation, and all three may be considered good wells. The yield of two of them was measured by the writer by means of a current meter, the water being allowed to flow in an open ditch. One of the wells, the O. H. Barnhart well (No. 19, Pl. VI), near Perry station, was out of repair, and could not be measured at the time it was visited, but it has been measured with a Cippoletti weir by F. D. Barnhart, who reports a yield of 880 gallons per minute. The J. T. Higgins well (No. 104) and the A. Wheeler well (No. 169) were measured by the writer March 24, 1916. The Higgins well consists of a 4 by 5 foot pit 94 feet deep and a 10-inch drilled well extending 116 feet below the bottom of the pit, giving a total depth of 210 feet. (See log on p. 89.) The well is equipped with a two-stage 3-inch belt-driven centrifugal pump with a vertical shaft and a 25-horsepower gasoline engine. On the day of the test the total lift was 65.8 feet, the yield 425 gallons per minute, and 1.02 gallons of distillate was burned per acre-foot per foot of lift. The drawdown during the test was 9.17 feet; hence the specific capacity of the well appears to be 46 gallons per minute.

The pit of the Wheeler well was originally 65 feet deep, but it had caved and filled until at the time of test it was about 40 feet deep. Fortunately, the well was covered, so that the dirt could not get into it. In the bottom of the pit is a 10-inch drilled well reaching 98 feet below the bottom of the pit, the total depth being, therefore, 163 feet. (See log on p. 91.) The well is equipped with a No. 4 belt-driven centrifugal pump with vertical shaft, driven by a 25-horsepower electric motor. The yield was found to be 718 gallons per minute, and electric current was consumed at the rate of 0.43 kilowatt hour per acre-foot per foot of lift. The drawdown during the test was 13.38 feet; hence the specific capacity of the well appears to be 54 gallons per minute.

The well of H. Robinson, a little over half a mile south of the proposed irrigation district, was also tested and found to yield only 145 gallons per minute. It is equipped with a small vertical centrifugal pump and a 7½-horsepower electric motor. The drawdown was 7.91 feet; hence its specific capacity appears to be 18 gallons per minute.

QUANTITY OF GROUND WATER AVAILABLE.

Although the development of the ground water within the proposed irrigation district has been very slight, so far as it goes it seems to show satisfactory results, and apparently wells in this area might be expected to yield enough water for irrigation. Indeed, the large and rapid fluctuation of the ground-water level indicates a rather large porosity for the alluvium, which would permit rather rapid transmission of water. The alluvium is composed, according to 69 well logs, of about 69 per cent clay, 29 per cent gravel, and 2 per cent sand. From the available data on porosity (see pp. 66–68) it has been concluded that the porosity of the sand and gravel is about 35 per cent of its volume, that of the clay 32 per cent, and that of the alluvium as a whole about 33 per cent.

The vital question in this connection is not so much the total porosity of the materials and the total quantity of ground water present as the quantity of water that these materials will yield under a pump. Different materials by no means give up water to a pump in the proportion of the total water they contain. Fine materials are usually better sorted than coarser materials and therefore when saturated they may contain even more water than the coarser materials, but they permanently retain a large percentage of this water, whereas the coarser materials readily part with a large percentage of their water content. The fine materials are therefore of comparatively little value as water producers and the coarse materials are the important water-bearing formations.

The following table shows the relative amount of water retained by sands of different degrees of fineness:

Quantity of water retained and given up by different sands after draining for 2½ years.[a]

Effective diameter of sand grains in millimeters.	Porosity of sands, expressed in percentage of total volume.	Quantity of water retained, expressed in percentage of total volume of the sands.	Quantity of water given up by the saturated sands, expressed in percentage of total volume of the sands.
0.47	38.86	6.57	32.29
.18	40.07	7.37	33.70
.16	40.76	10.35	30.41
.12	40.57	12.49	28.08
.08	39.73	14.09	25.64

[a] This table is based on tables given by King (U. S. Geol. Survey Nineteenth Ann. Rept., pt. 2, pp. 90, 91, 1899).

It will be seen from this table that the coarsest of the five sands tested gives up a quantity of water equal to 32.29 per cent of the total volume of the sand, or somewhat more than 83 per cent of the water it contains. The gravel and sand of the Morgan Hill district are on the whole considerably coarser than this sand and would give up a larger proportion of their water. For purposes of calculation it is assumed that they would give up about 90 per cent of their total water content. If the alluvium includes 29 per cent of gravel and 2 per cent of sand, these materials will hold a quantity of water equal to 10.85 per cent of the total volume of the saturated alluvium; if they will yield 90 per cent of this water they will furnish a quantity of water equal to 9.77 per cent of the total volume of the saturated alluvium. The clays form about 69 per cent of the alluvium, and their average porosity is about 33 per cent of their total volume. Clays give up a very small percentage of the water they contain. It is stated by King [1] that clays of fine texture may retain as much as 32 per cent of their dry weight of water.

The materials called clay in the Morgan Hill area are not true clays but perhaps more nearly clay loam, so that the quantity of water they retained would be considerably less than that retained by fine clay. The porosity of fine clays would be greater, but the clays from which the porosity data here used were obtained were not true clays, and hence it is believed that their average porosity represents the porosity of the clays of the Morgan Hill area. It is thought that 90 per cent of the amount required for saturation is a liberal estimate for the quantity of water retained by the clays of the Morgan Hill area—that is, they would give up 10 per cent of the amount required to saturate them. As about 69 per cent of the alluvium is clay and the porosity of this clay is taken as 33 per cent of its volume, the pore space in the clay is equal to about 22.77 per cent of the total volume of the alluvium. If it gives up 10 per cent of the water required for saturation the clay would yield a quantity of water equal to 2.28 per cent of the volume of the saturated alluvium. The total water that the saturated alluvium will give up is therefore calculated to be 12.06 per cent of its volume.

According to planimeter measurements made on Plate VI there is within the portion of the valley covered by this report an area of 11,130 acres over which the rise of the water table from the fall of 1914 to March, 1916, was from 10 to 20 feet, with an average of about 15 feet, an area of about 3,100 acres over which the rise was from 20 to 30 feet, with an average of about 25 feet, and an area of about 1,500 acres over which the rise was more than 30 feet, for the most part from 30 to 45 feet, with an average of perhaps 37.5 feet. The rise is due to recharge, and the volume of water represented by the

[1] King, F. H., op. cit., p. 71.

recharge is equal to the volume of the alluvium that became saturated with water during the rise, multiplied by the percentage of available porosity. As the pores were not entirely empty before this recharge but presumably contained such water as did not drain out after the preceding high stage, the available porosity to be used in this calculation is 12.06 per cent, as given in the preceding paragraph. From the curves shown in figure 10 it is assumed that the annual fluctuation of the water table in the season 1914–15 was 1 foot less than the fluctuation for the period from the fall of 1914 to March, 1916. Calculated on this basis, the recharge for the season 1914–15 amounted to 18,776 acre-feet in the first area, 8,965 acre-feet in the second area, and 6,597 acre-feet in the third area. This gives a recharge beneath the whole area under consideration (15,730 acres) of 34,338 acre-feet, or 2.18 acre-feet per acre.

In 1914–15 the conditions for ground-water recharge were somewhat more favorable than in an average year, as the precipitation was generally above the average and was rather well distributed. At Morgan Hill the average is 23.55 inches and that for 1914–15 was 26.95; the average at San Francisco is 22.63, and that for 1914–15 was 27.41; the average at San Jose is 15.41 and that for 1914–15 was 22.71; the average for Gilroy is 20.73 and that for 1914–15 was 21.22. The Lick Observatory station seems to be an exception to the rule, as the average annual precipitation at this station for a period of 35 years is 31.33 inches, whereas the precipitation in 1914–15 was only 27.75 inches. It would seem from these data that the precipitation of 1914–15 was in general considerably above the average, but that for the Lick Observatory, near the headwaters of Coyote River, was 3.58 inches below normal. It is not known whether the average on the Coyote drainage basin was above or below normal, and unfortunately the records of the discharge of Coyote River for this year are not available. The rainfall records, however, lead to the conclusion that the conditions for recharge for this season were somewhat better than the average.

The accuracy of the above-described method of determining the available pore space of materials may be questioned, and it is therefore desirable to check these results by calculating porosity from other and entirely independent data.

In 1904–5 the Bay Cities Water Co. conducted a pumping test at the lower gorge of Coyote River, about 8 miles northwest of Morgan Hill. An attempt is here made to determine the approximate storage capacity of the alluvium by making use of two curves which were prepared by Mr. H. L. Haehl, hydraulic engineer for the company, on the basis of data obtained from this test. One curve, not reproduced in this paper, shows the quantity of water pumped; the other (Exhibit B, in the case of Charles Miller *v.* Bay Cities Water Co.), reproduced in simplified form in figure 11, shows the lowering of the

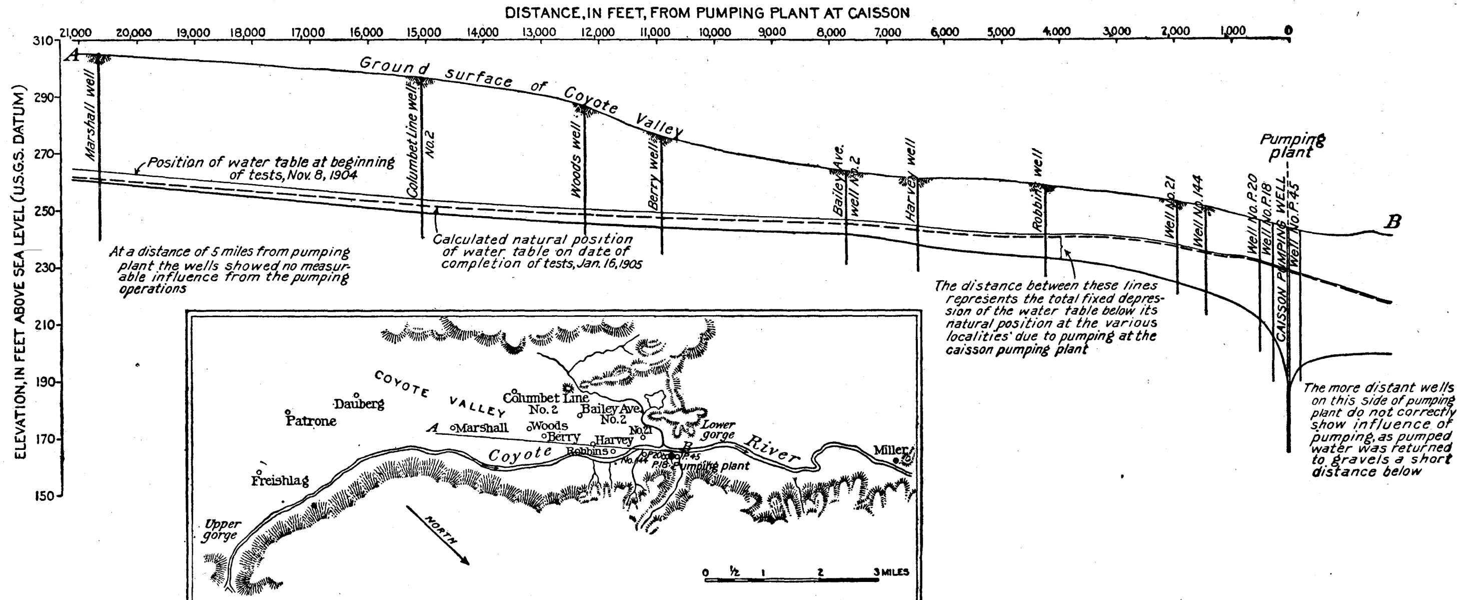


FIGURE 11.—Section and sketch map showing effect on water table produced by pumping test of Bay Cities Water Co. at the lower gorge of Coyote River, Morgan Hill area, Cal., Nov. 8, 1904, to Jan. 16, 1905. (Exhibit B, case of Miller *v.* Bay Cities Water Co.)

water table due to pumping. The pumpage ranged between 8,000,000 and 20,000,000 gallons a day, and from November 15, 1904, to January 16, 1905, amounted to 535,372,000 gallons, or 1,643 acre-feet. The following table gives the estimated area, depth, and volume of alluvium drained by the pumping operations. There was no observed lowering of the water table due to pumping at distances more than 5 miles from the pump.

Area, depth, and volume of alluvium drained by pumping test of Bay Cities Water Co., Nov. 15, 1904–Jan. 15, 1905.

	Area underlain by alluvium.[a]	Average lowering of water table due to pumping.[b]	Volume of material drained.
	Acres.	*Feet.*	*Acre-feet.*
Less than half a mile south of pump	128	17.5	2,240
Between ½ and 1 mile south of pump	428	7.7	3,296
Between 1 and 1½ miles south of pump	460	4.7	2,208
Between 1½ and 5 miles south of pump	3,584	1.8	6,451
	....	....	14,195

[a] Based on planimeter measurements. [b] Based on fig. 11.

If the volume of materials drained was 14,195 acre-feet and the quantity of water pumped 1,643 acre-feet, the available pore space was 11.6 per cent. This figure is in close agreement with the 12.06 per cent found by the first method. The calculations by the first method were completed before any of the data used in the second method had been obtained, and the two results are therefore entirely independent of each other. The close agreement is of course accidental, but the fact that the two methods lead to the same general result is probably significant. It should be recognized that the base data are far from being adequate for the purpose for which they are used. The amounts of water that percolated into the area, that escaped northward through the gravels in the lower gap, and that was drawn to the pump from the area below the gap are undetermined and introduce large uncertainties.

These results may be checked in still another way. By using 12.06 per cent as the porosity factor the recharge of ground water in 1914–15 was found to be 2.18 acre-feet per acre. If this figure is used also for the 1,466 acres lying north of the area covered in this report and south of the lower gorge the recharge between the upper and the lower gorges equals 37,487 acre-feet. If 80 per cent came from Coyote River the recharge from this source was 29,990 acre-feet. According to the table of absorption on page 74 the recharge from Coyote River was 11,127 acre-feet in 1903–4, 16,010 acre-feet in 1904–5, 20,346 acre-feet in 1905–6, and 36,021 acre-feet in 1906–7.

Thus the results calculated from the percentage of porosity used in this report seem to be compatible with measured losses from Coyote River.

ADEQUACY OF GROUND-WATER SUPPLY FOR IRRIGATION.

It is impossible to recover within the area all the water that per colates into the alluvium, for the ground water is continuously moving so that the water is leaving the area at both the north and the south ends all the time. However, the recharge of 2.18 acre-feet per acre is exclusive of the loss in the period of rising water, December to March, inclusive, during which probably one-third of the annual loss occurs. If the land is brought under irrigation a part of the water that is pumped will be returned to the ground-water supply. Moreover, if the water table is lowered by pumping, the recharge aside from the return water may be increased. The balance between all these factors is highly uncertain, the percentages of porosity used in the calculations are no doubt considerably in error, and the extent to which the average annual recharge may fall short of the recharge in 1914–15 is not known. However, it appears probable that as much as one-half of the calculated recharge, or approximately 1 acre-foot per acre, will be annually available for irrigation within the district.

It is estimated by Adams [1] that two 6-inch irrigations, or 1 acre-foot per acre, in a year are sufficient for orchards and that about 2½ acre-feet is required for alfalfa. Hence it appears that by judicious use the supply of ground water will be practically sufficient to meet the needs of irrigation, especially if most of the area is planted to orchard. The supply used in the Morgan Hill area will be in part water that would otherwise go to waste and in part water that would otherwise be used on the lower lands on each side of this area. It is not believed, however, that the development in the Morgan Hill area will seriously deplete the supply for irrigation in adjacent areas.

WELL TABLES.

Logs of wells in the vicinity of Morgan Hill, Cal.

[Furnished by George A. Hamilton, driller.]

No. 7. Manuel Costa.			No. 12. George Topham.		
	Thickness.	Depth.		Thickness.	Depth.
	Feet.	*Feet.*		*Feet.*	*Feet.*
Soil	15	15	Soil	42	42
Gravel	7	22	Gravel	4	46
Clay	25	47	Clay	15	61
Gravel	6	53	Gravel	4	65

[1] Unpublished report of Frank Adams, U. S. Dept. Agr.

Logs of wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 14. —— Holister.

	Thickness.	Depth.
	Feet.	*Feet.*
Pit	30	30
Clay	25	55
Gravel	5	60
Clay	90	150

No. 16. George Lee.

Soil	15	15
Gravel	29	44
Clay	14	58
Gravel	6	64
Sandy clay	56	120
Yellow clay	20	140
Gravel	16	156

No. 17. Antone Moniz.

Soil	20	20
Clay	39	59
Gravel	4	63
Clay	33	96
Gravel	12	108

No. 20. F. Barnhardt.

Soil	20	20
Gravel	15	35
Clay	30	65
Clay and gravel	10	75
Gravel	9	84

No. 21. J. Shepheard.

Soil	20	20
Gravel	15	35
Clay	42	77
Gravel	20	97
White clay	2	99
Gravel	3	102
Clay	20	122

No. 22. La Burcherie Bros.

Pit	47	47
Clay	9	56
Gravel	3	59
Clay	10	69
Gravel	3	72
Clay	126	198
Gravel	9	207
Blue clay	50	257

No. 34. Santa Clara County.

Soil	23	23
Clay	20	43
Gravel	7	50
Clay	25	75
Gravel	7	82

No. 44. Joseph Leggie.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	20	20
Clay and gravel	40	60
Gravel	12	72

No. 46. P. Patrone.

Soil	15	15
Angular gravel	20	35
Clay	22	57
Gravel	15	72

No. 47. John Burke.

Soil	15	15
Angular gravel	20	35
Clay	22	57
Gravel	13	70

No. 49. L. Bernal.

Pit	25	25
Clay and angular gravel	15	40
Clay	20	60
Gravel	13	73

No. 50. H. Shurlock.

Pit	30	30
Clay and angular gravel	8	38
Clay	20	58
Gravel	16	74

No. 55. ——— Goodwin.

Soil	15	15
Gravel	3	18
Clay and boulders	38	56

No. 61. George Powell.

Soil	43	43
Gravel	4	47
Clay and boulders mixed	47	94
Gravel	3	97

No. 64. F. Craft.

Soil	16	16
Boulders	30	46
Clay	16	62
Gravel	8	70
Clay	50	120
Mixed clay and gravel	25	145

Logs of wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 73. F. Espanosa.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	20	20
Gravel	16	36
Clay	27	63
Gravel	8	71

No. 80. —— Taylor.

Soil	38	38
Gravel	7	45
Clay	24	69
Gravel	6	75

No. 81. Stephen Kay.

Soil	33	33
Gravel	5	38
Clay	30	68
Gravel	4	72

No. 87. Dr. Downey.

Adobe	7	7
Clay	127	134
Gravel	4	138
Bedrock, decomposed	8	146

No. 88. E. J. Votaw.

Soil	20	20
Clay and angular rock fragments	110	130
Gravel	4	134
Clay	18	152
Bedrock at 152 feet.		

No. 89. —— Boutell.

Soil	26	26
Bedrock	27	53

No. 90. —— Smith.

Soil	40	40
Gravel	3	43
Clay	30	73
Gravel	6	79
Clay	49	128

No. 93. —— Jacobsen.

Soil	35	35
Clay	40	75
Gravel	4	79
Clay	30	109
Gravel	4	113
Clay	13	126
Gravel	2	128

No. 94. Union High School, Morgan Hill.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	12	12
Clay	35	47
Gravel	6	53
Clay	40	93
Gravel	9	102

No. 102. E. S. Dyer.

Soil	30	30
Clay	30	60
Gravel	7	67
Clay	20	87
Gravel	10	97
Clay	4	101
Gravel	12	113

No. 103. Santa Clara County.

Soil	68	68
Gravel	6	74
Clay	35	109
Gravel	5	114

No. 104. Dr. J. T. Higgins.

Pit	94	94
Sand	26	120
Gravel	26	146
Clay	9	155
Gravel	13	168
Clay	3	171
Gravel	39	210

No. 113. Knowl & Henngardner.

Soil	30	30
Clay	27	57
Gravel	9	66
Boulders	12	78
Gravel	3	81
Clay and gravel mixed	48	129
Gravel	6	135

No. 114. —— Carlson.

Soil	20	20
Boulders	18	38
Gravel	4	42
Clay	35	77
Gravel	19	96

No. 119. —— Norman.

Soil	18	18
Clay	42	60
Sand	7	67
Gravel	8	75
Sand	9	84
Clay	30	114
Gravel	9	123

Logs of wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 122. A. Horn.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	40	40
Gravel	6	46
Clay	20	66
Gravel	3	69
Clay	15	84
Quicksand	7	91
Clay	21	112

No. 123. J. C. Peterson.

Soil	32	32
Gravel and clay	23	55
Gravel	7	62
Clay	30	92
Sand	17	109
Clay	16	125
Gravel	39	164

No. 127. T. Dassell.

108 to 116 feet, coarse gravel.

No. 131. —— White.

Soil	30	30
Clay	35	65
Gravel	5	70
Clay	30	100
Gravel	15	115

No. 132. P. J. Dunne.

Soil	45	45
Clay	30	75
Gravel	7	82
Clay	55	137
Gravel	4	141

No. 134. Roy Hatch.

Pit	75	75
Gravel	7	82
Clay	30	112
Gravel and clay	20	132
Fine gravel	8	140

No. 136. —— Johnston.

Soil	25	25
Clay	30	55
Gravel	6	61
Clay	27	88
Gravel	7	95
Clay	6	101
Gravel	7	108

No. 142. Tim Reno.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	35	35
Gravel	34	69
Clay	35	104
Gravel	6	110

No. 143. William Hatch.

Soil	35	35
Clay	40	75
Gravel	8	83
Clay	25	108
Gravel	9	117

No. 146. Mrs. Wilkie.

Soil	30	30
Gravelly clay	32	62
Gravel	11	73
Clay	20	93
Gravel	6	99
Clay	12	111
Gravel	6	117

No. 147. P. J. Dunne.

Pit	70	70
Clay	48	118
Angular gravel	12	130
Clay	13	143
Gravel	5	148
Clay	52	200

No. 148. —— McFail.

Soil	35	35
Clay	28	63
Gravel	3	66
Clay	45	111
Gravel	5	116

No. 151. —— Newboldt.

Soil	30	30
Clay	30	60
Gravel	4	64
Clay	13	77
Gravel	2	79
Clay	29	108
Gravel	7	115

No. 152. P. Locarnini.

Soil	30	30
Gravel	40	70
Clay	36	106
Gravel and sand	21	127

Logs of wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 153. Albert Hintz.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	30	30
Gravel	32	62
Clay	55	117
Gravel	7	124

No. 155. Lee Payne.

Soil	20	20
Gravel	27	47
Clay	11	58
Gravel	4	62
Clay	40	102
Gravel	14	116

No. 156. James Castillon.

Soil	13	13
Clay	45	58
Gravel and clay mixed	3	61
Clay	50	111
Gravel	4	115

No. 157. G. F. Slankard.

Pit	19	19
Gravel	23	42
Clay	8	50
Gravel	45	95

No. 158. M. S. Byers.

Soil	42	42
Clay	8	50
Gravel	35	85
Clay	16	101
Gravel	12	113

No. 159. T. Cathers.

Soil	30	30
Clay	35	65
Gravel	6	71
Clay	20	91
Gravel	4	95

No. 160. —— Wards.

Soil	30	30
Gravelly clay	32	62
Gravel	11	73
Clay	20	93
Gravel	6	99
Clay	12	111
Gravel	6	117

No. 164. Shillings & Ahern.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	35	35
Clay	18	53
Gravel	4	57
Clay	17	74
Gravel	8	82
Clay and sand	40	122

No. 166. —— Paul.

Soil	30	30
Clay	35	65
Gravel	7	72
Clay	35	107
Gravel	14	121

No. 168. C. Bronner.

Soil	40	40
Gravel	3	43
Clay	17	60
Gravel	3	63
Clay	51	114

No. 169. A. Wheeler.

Pitt	65	65
Sandy clay	16	71
Gravel	9	80
Yellow clay	41	121
Coarse gravel and clay	33	154
Clay	9	163

No. 170. William Linden.

Soil	17	17
Gravel	58	75

No. 171. F. Tremoureux.

Soil	40	40
Clay	10	50
Gravel	3	53
Clay	45	98
Gravel	2	100

No. 173. Thomas Miller.

Pit	11	11
Clay	19	30
Gravel and clay	97	127
Gravel	3	130
Red clay	65	195

Logs of wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 174. Bisceglia Bros.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	16	16
Clay	45	61
Gravel	4	65
Clay	37	102
Gravel	5	107
Clay	6	113
Gravel	2	115

No. 175. Cemetery, Morgan Hill.

Soil	12	12
Clay	38	50
Bedrock	3	53

No. 176. Leonard Coats.

Soil	29	29
Gravel	7	36
Bedrock	9	45

No. 182. —— Cabbarera.

Soil	15	15
Bedrock	15	30

No. 183. —— Courtright.

Soil	18	18
Clay	32	50
Gravel	2	52
Bedrock at 52 feet.		

No. 185. Santa Clara County.

Soil	20	20
Gravel	20	40
Clay	24	64
Gravel	12	76

No. 186. J. M. Squibb.

	Thickness.	Depth.
	Feet.	*Feet.*
Soil	15	15
Gravel	28	43

No. 192. —— Seilsbee.

Soil	32	32
Gravel	6	38
Clay	26	64
Gravel	9	73

No. 193. —— Housenecht.

Soil	34	34
Gravel	7	41
Clay	24	65
Gravel	6	71

No. 194. —— Kroft.

Soil	34	34
Gravel	6	40
Clay	24	64
Gravel	9	73

No. 196. W. R. Lindsay.

Soil	20	20
Clay	23	43
Gravel	6	49
Clay	40	89
Gravel	7	96
Clay	5	101
Gravel	2	103

No. 213. Andrew Ross.

Soil	17	17
Clay	12	29
Gravel	4	33
Clay	26	59
Gravel	19	78

Water levels in wells in the vicinity of Morgan Hill, Cal.

No. 1. —— Richmond.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 22, 1914	286.15	31.33	254.82
Feb. 8, 1916	....	12.86	273.29
Mar. 18, 1916	....	13.21	272.94

No. 2. —— Porter.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 22, 1914	285.04	26.80	258.24
Feb. 8, 1916	....	9.02	276.02
Mar. 18, 1916	....	9.19	275.85

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 3. —— Sheriffs.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 22, 1914	291.32	32.34	258.98
Feb. 8, 1916	....	12.57	278.75
Mar. 18, 1916	....	12.66	278.66

No. 4. P. J. Wooley.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 22, 1914	296.43	43.88	252.55
Dec. 13, 1914	....	43.75	252.68
Jan. 10, 1915	....	28.66	267.77
Feb. 13, 1915	....	14.00	182.43
Feb. 14, 1915	....	14.00	282.43
Feb. 28, 1915	....	13.75	282.68
Mar. 7, 1915	....	14.17	282.26
Mar. 21, 1915	....	14.83	281.60
Apr. 18, 1915	....	15.83	280.60
May 9, 1915	296.43	16.42	280.01
Feb. 8, 1916	....	14.10	282.33
Mar. 18, 1916	....	14.94	281.49

No. 5. ——.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 8, 1916	297.06	13.03	284.03
Mar. 18, 1916	....	13.15	283.91

No. 6. Manuel Costa.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 8, 1916	293.20	5.03	287.17
Mar. 18, 1916	....	4.56	288.64

No. 8. John Shepard.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 21, 1914	298.24	30.78	267.46
Dec. 1, 1914	....	31.58	266.66
Jan. 10, 1915	....	23.50	274.74
Feb. 1, 1915	....	15.32	282.92
Feb. 9, 1915	....	9.66	288.58
Mar. 1, 1915	....	5.92	292.22
Apr. 6, 1915	....	6.75	291.49
May 1, 1915	....	7.75	290.49
Feb. 8, 1916	....	6.10	292.14
Mar. 18, 1916	....	5.69	292.55

No. 9. Mathew Smith.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 21, 1914	290.08	25.44	264.64
Feb. 8, 1916	....	3.16	286.92
Mar. 18, 1916	....	2.44	287.64

No. 10. —— (Chinaman).

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 8, 1916	288.35	5.65	282.70
Mar. 18, 1916	....	4.26	284.09

No. 11. O. Christopher.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 8, 1916	296.20	7.01	289.19
Mar. 18, 1916	....	5.67	290.53

No. 13. P. A. Ramelli.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 21, 1914	302.45	31.38	271.07
Feb. 8, 1916	....	9.86	292.59
Mar. 18, 1916	....	7.32	295.13

No. 15. H. A. Peppin.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 20, 1914	307.88	31.46	276.42
Dec. 2, 1914	....	32.33	275.55
Jan. 10, 1915	....	25.21	282.67
Jan. 29, 1915	....	20.75	287.13
Feb. 9, 1915	....	15.75	292.13
Feb. 19, 1915	....	12.42	295.46
Feb. 24, 1915	....	11.21	296.67
Mar. 7, 1915	....	9.66	298.22
Mar. 22, 1915	....	9.25	298.63
Mar. 29, 1915	....	9.25	298.63
Apr. 21, 1915	....	10.33	297.55
May 17, 1915	....	11.00	296.88
Feb. 8, 1916	....	10.76	297.12
Mar. 18, 1916	....	8.54	299.34

No. 17. Antone Moniz.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 8, 1916	309.51	13.44	196.07
Mar. 18, 1916	....	10.70	298.81

No. 18. Road well.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 21, 1914	305.40	34.52	270.88
Feb. 8, 1916	....	8.29	297.11
Mar. 18, 1916	....	7.29	298.11

No. 19. O. H. Barnhart.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 21, 1914	309.56	39.76	269.80
Feb. 8, 1916	....	9.10	300.46
Mar. 18, 1916	....	9.54	300.02

No. 23. E. G. Sharon.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 20, 1914	323.62	45.66	277.96
Dec. 1, 1914	....	43.58	280.04
Jan. 10, 1915	....	14.17	309.45
Feb. 1, 1915	....	10.42	313.20
Feb. 8, 1916	....	8.66	314.96
Mar. 18, 1916	....	10.00	313.62

No. 24. E. G. Sharon.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 8, 1916	332.26	9.88	322.38
Mar. 18, 1916	....	10.92	321.34

No. 25. P. Tarp.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 20, 1914	322.05	38.77	283.28
Dec. 4, 1914	....	41.83	280.22
Jan. 11, 1915	....	32.75	289.30
Feb. 3, 1915	....	26.83	295.22

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 25. P. Tarp—Continued.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 19, 1915	....	20.66	301.39
Feb. 24, 1915	....	19.58	302.47
Mar. 10, 1915	....	18.04	304.01
Mar. 26, 1915	....	17.54	304.51
Apr. 26, 1915	....	18.50	303.55
Feb. 7, 1916	....	19.32	302.73
Mar. 18, 1916	....	16.87	305.18

No. 26. S. M. Rossi Co.

Nov. 20, 1914	311.09	31.42	279.67
Dec. 1, 1914	....	30.54	280.55
Jan. 11, 1915	....	30.33	280.66
Feb. 8, 1916	....	16.79	294.30
Mar. 18, 1916	....	11.73	299.36

No. 27. G. B. Cushing.

Feb. 8, 1916	308.46	13.70	294.76
Mar. 18, 1916	....	8.58	299.88

No. 28. G. P. Blaine.

Feb. 8, 1916	307.05	12.28	294.77
Mar. 18, 1916	....	7.39	299.66

No. 29. ———.

....	....	22.75	....

No. 30. ———.

Feb. 7, 1916	307.05	9.76	297.09
Mar. 18, 1916	....	5.64	301.41

No. 31. ———.

Feb. 7, 1916	310.80	6.06	304.74
Mar. 18, 1916	....	4.16	306.64

No. 32. A. J. Nielsen.

Feb. 7, 1916	319.97	16.77	303.18
Mar. 18, 1916	....	14.21	305.76

No. 33. Rudolph Miana.

Nov. 20, 1914	325.92	34.91	291.01
Dec. 1, 1914	....	34.33	291.59
Jan. 10, 1915	....	32.83	293.09
Jan. 23, 1915	....	29.17	296.75
Feb. 19, 1915	....	17.17	308.75
Mar. 7, 1915	....	15.83	310.09
Mar. 22, 1915	....	16.00	309.92
Mar. 29, 1915	....	16.00	309.92
Feb. 7, 1916	....	16.42	309.50
Mar. 18, 1916	....	15.32	310.60

No. 35. M. Mast.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 21, 1914	341.77	49.72	282.05
Feb. 8, 1916	....	13.08	328.69
Mar. 18, 1916	....	14.80	326.97

No. 36. Mrs. Rogan.

Nov. 21, 1914	346.33	52.28	294.05
Dec. 1, 1914	....	52.16	293.17
Feb. 8, 1916	....	16.16	330.17
Mar. 18, 1916	....	18.62	327.71

No. 37. Mrs. Rogan.

Nov. 21, 1914	348.26	53.10	295.16
Dec. 1, 1914	....	54.17	294.09
Feb. 8, 1916	....	28.64	319.62
Mar. 18, 1916	....	28.66	319.60

No. 38. Kirby Estate.

Nov. 21, 1914	355.06	43.97	311.09
Dec. 1, 1914	....	44.50	310.56
Feb. 8, 1916	....	16.93	338.13
Mar. 18, 1916	....	19.72	335.34

No. 39. —— Reynolds.

Feb. 7, 1916	333.03	10.54	322.49
Mar. 18, 1916	....	12.90	320.13

No. 40. B. Martella.

Nov. 11, 1914	330.05	31.45	298.60
Feb. 7, 1916	....	14.72	315.33
Mar. 18, 1916	....	15.13	314.92

No. 41. B. Martella.

Dec. 1, 1914	327.43	30.58	297.05
Jan. 10, 1915	....	31.33	296.10
Jan. 30, 1915	....	27.75	299.68
Feb. 17, 1915	....	16.33	311.10
Feb. 23, 1915	....	15.00	312.43
Mar. 9, 1915	....	14.92	312.51
Mar. 22, 1915	....	14.83	312.60
Mar. 27, 1915	....	14.50	312.93
Apr. 13, 1914	....	15.33	292.10
May 18, 1915	....	14.58	212.85
Feb. 7, 1916	....	12.45	314.98
Mar. 18, 1916	....	13.28	314.15

No. 42. ———.

Nov. 11, 1914	320.74	21.75	298.99
Feb. 7, 1916	....	6.36	314.38
Mar. 18, 1916	....	7.37	313.37

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 43. G. F. Plyler.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 11, 1914	327.99	24.80	303.19
Feb. 7, 1916	....	10.28	317.71
Mar. 18, 1916	....	12.43	315.56

No. 44. G. Legge.

Feb. 7, 1916	328.91	8.43	320.57
Mar. 18, 1916	....	10.63	318.28

No. 45. ———.

Feb. 7, 1916	331.85	7.89	323.96
Mar. 18, 1916	....	10.41	321.44

No. 47. John Burk.

Feb. 7, 1916	335.00	8.90	326.10
Mar. 18, 1916	....	11.40	323.60

No. 48. Mrs. Casio.

Nov. 11, 1914	336.37	30.82	305.55
Feb. 7, 1916	....	9.95	326.42
Mar. 17, 1916	....	12.73	323.64

No. 51. P. Raggio.

Nov. 11, 1914	353.04	42.77	310.27
Dec. 8, 1914	....	49.92	303.12
Jan. 11, 1915	....	44.33	308.71
Jan. 28, 1915	....	42.25	310.79
Feb. 10, 1915	....	26.08	326.96
Feb. 19, 1915	....	20.00	333.04
Feb. 24, 1915	....	19.00	334.04
Mar. 6, 1915	....	18.50	334.54
Mar. 18, 1915	....	18.00	335.04
Mar. 30, 1915	....	19.50	333.54
Feb. 8, 1916	....	17.16	335.88
Mar. 18, 1916	....	19.14	333.90

No. 52. ———.

Nov. 11, 1914	....	47.87	....

No. 53. Stefano Puppo.

Nov. 11, 1914	....	43.23	....

No. 54. ———.

Jan. 15, 1916	378.15	35.87	342.28
Mar. 17, 1916	....	26.60	351.55

No. 56. R. C. Howe.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
....	....	50 (dry).	....

No. 57. W. G. Rhodes.

Well unsuccessful; about 500 feet deep.

No. 58. W. G. Rhodes.

Good for domestic purposes only; about 110 feet deep.

No. 59. R. C. Howe.

Feb. 3, 1916	404.64	48.67	355.97
Mar. 17, 1916	....	47.50	357.14

No. 60. R. C. Howe.

No data.

No. 61. George J. Powell.

Nov. 10, 1914	395.46	58.57	336.89
Jan. 13, 1915	....	59.66	335.80
Feb. 1, 1915	....	58.00	337.46
Feb. 12, 1915	....	36.00	359.46
Feb. 17, 1915	....	44.00	351.46
Feb. 24, 1915	....	42.83	352.63
Mar. 10, 1915	....	40.83	354.63
Mar. 28, 1915	....	40.50	354.96
Apr. 15, 1915	....	40.00	355.46
May 17, 1915	....	45.17	350.29
Jan. 15, 1916	....	53.60	341.86
Feb. 3, 1916	....	41.03	354.43
Mar. 17, 1916	....	40.10	355.36

No. 62. H. D. Pete.

Nov. 10, 1914	392.83	74.26	318.57
Dec. 11, 1914	....	[a] 78.00	[a] 315.00
Jan. 30, 1915	....	74.00	318.83
Feb. 21, 1915	....	62.00	330.83
Mar. 14, 1915	....	54.00	338.83
Mar. 24, 1915	....	54.00	338.83
Apr. 19, 1915	....	56.00	336.83
Jan. 15, 1916	....	72.17	320.66
Mar. 17, 1916	....	57.67	335.16

No. 63. William Pierce.

Nov. 10, 1914	382.20	76.43	305.77
Dec. 9, 1914	....	69.17	313.03
Feb. 8, 1915	....	59.58	322.62
Mar. 9, 1915	....	68.58	313.62
Mar. 29, 1915	....	58.66	323.54
Jan. 15, 1916	....	59.37	322.83
Mar. 17, 1916	....	47.82	334.38

No. 64. F. Croft.

Jan. 15, 1916	383.97	[b] 33.97	350.02
Mar. 17, 1916	....	28.76	355.21

[a] Approximate.

[b] Measurement checked high.

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
No. 65. Road well.			
Jan. 15, 1916	373.39	52.10	321.29
Mar. 17, 1916	....	40.25	333.14
No. 66. ——— (Chinaman).			
Jan. 15, 1916	376.03	55.96	320.07
Mar. 17, 1916	....	36.85	339.18
No. 67. Twin Oaks ranch.			
Feb. 3, 1916	370.44	36.58	333.86
Mar. 17, 1916	....	38.93	331.51
No. 68. Vincent Rosso.			
Nov. 10, 1914	365.91	49.00	316.91
Feb. 3, 1916	....	33.86	332.05
Mar. 17, 1916	....	34.59	331.32
No. 69. Jack Bevilaqua.			
Nov. 11, 1914	366.93	53.26	313.67
Jan. 12, 1915	....	33.00	333.93
Feb. 7, 1915	....	30.50	336.43
Jan. 15, 1916	....	45.42	321.51
Mar. 17, 1916	....	29.02	337.91
No. 70. G. Travasco.			
Nov. 11, 1914	361.98	50.88	311.10
Jan. 15, 1916	....	43.61	318.37
Mar. 17, 1916	....	30.20	331.78
No. 71. C. Conlan.			
Nov. 11, 1914	....	39.14	....
No. 72. Ben Patrone.			
Jan. 15, 1916	347.73	28.86	318.87
Mar. 17, 1916	....	19.42	328.31
No. 74. Guido Bros.			
Jan. 15, 1916	357.34	41.00	316.34
Mar. 17, 1916	....	28.28	329.06

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
No. 75. John Attos.			
Jan. 15, 1916	350.12	33.36	316.76
Mar. 17, 1916	....	21.16	328.96
No. 76. Road well.			
Jan. 15, 1916	351.10	34.48	316.62
Mar. 17, 1916	....	23.30	327.80
No. 77. F. H. Earls.			
Dec. 10, 1914	350.03	35.00	315.03
Dec. 11, 1914[a]	....	35.00	315.03
Feb. 7, 1916	....	20.71	329.32
Mar. 17, 1916	....	18.40	331.63
No. 78. P. F. Compagnon.			
Nov. 11, 1914	354.48	19.05	335.43
Dec. 4, 1914	....	25.00	329.48
Jan. 13, 1915	....	21.42	333.06
Jan. 30, 1915	....	21.00	333.48
Feb. 20, 1915	....	12.00	342.48
Mar. 8, 1915	....	18.00	336.48
Mar. 23, 1915	....	20.00	334.48
Mar. 27, 1915	....	20.00	334.48
Apr. 17, 1915	....	19.66	334.82
Feb. 7, 1916	....	7.44	347.04
Mar. 17, 1916	....	4.00	350.48
No. 79. W. R. Sterrett.			
Feb. 7, 1916	354.76	9.82	344.94
Mar. 17, 1916	....	5.38	349.38
No. 82. ———.			
Nov. 11, 1914	353.24	25.10	328.14
Feb. 7, 1916	....	16.10	337.14
Mar. 17, 1916	....	10.80	342.44
No. 83. Peter Bender.			
Nov. 10, 1914	354.52	39.45	315.07
Dec. 5, 1914	....	42.66	311.86
Jan. 12, 1915	....	43.41	311.11
Jan. 28, 1915	....	40.32	314.20
Feb. 6, 1915	....	40.00	314.52
Feb. 18, 1915	....	34.66	319.86
Feb. 23, 1915	....	33.32	321.20
Mar. 8, 1915	....	30.66	323.86
Mar. 22, 1915	....	29.66	324.86
Mar. 29, 1915	....	29.16	325.36
Apr. 16, 1915	....	28.58	325.94
May 15, 1915	....	29.32	325.20
Jan. 15, 1916	....	36.61	317.91
Mar. 17, 1916	....	24.60	329.92

[a] Dec. 11, 1914, to Apr. 17, 1915, evidently poor measurements.

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 84. Higgins & Sterrett.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 11, 1914	352.82	49.82	303.00
Dec. 15, 1914	....	50.25	302.57
Feb. 24, 1915	....	65.00	287.82
Jan. 15, 1916	....	35.42	316.08
Mar. 17, 1916	....	23.76	329.06

No. 85. —— McMann.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 7, 1916	350.62	20.88	329.74
Mar. 17, 1916	....	25.73	324.89

No. 86. Lillian McMullen.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 11, 1914	....	26.02	....

No. 91. John Arton.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 9, 1915	347.41	42.02	305.39
Feb. 3, 1916	....	30.02	317.39
Mar. 17, 1916	....	26.55	320.86

No. 92. E. A. Johnson.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 3, 1916	345.53	18.95	326.58
Mar. 17, 1916	....	19.63	325.90

No. 95. M. E. Payne.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 10, 1914	350.31	34.57	315.74
Dec. 1, 1914	....	41.66	308.65
Jan. 9, 1915	....	40.00	310.31
Jan. 27, 1915	....	40.00	310.31
Feb. 23, 1915	....	32.00	318.31
Mar. 8, 1915	....	28.00	322.31
Mar. 20, 1915	....	27.00	323.31
Mar. 26, 1915	....	27.00	323.31
Apr. 18, 1915	....	27.00	323.31
May 27, 1915	....	27.00	323.31
Jan. 15, 1916	....	34.23	316.08
Mar. 17, 1916	....	24.00	326.31

No. 96. T. F. McConnell.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 16, 1916	358.51	48.36	310.15
Mar. 17, 1916	....	37.20	321.31

No. 97. C. R. Cooper.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 28, 1916	361.36	46.44	314.92
Mar. 17, 1916	....	46.06	315.30

No. 98. D. P. Weichert.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 10, 1914	361.87	53.93	307.94
Nov. 5, 1914	....	54.92	306.95
Dec. 16, 1916	....	52.03	309.84
Jan. 28, 1916	....	45.40	316.47
Mar. 17, 1916	....	44.76	317.11

No. 99. Z. Bagwill.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 10, 1914	369.78	61.15	308.63
Jan. 22, 1915	....	62.60	307.18
Feb. 10, 1915	....	59.00	310.78
Feb. 17, 1915	....	55.25	314.53
Feb. 26, 1915	....	51.58	318.20
Mar. 9, 1915	....	47.75	322.03
Mar. 25, 1915	....	45.58	324.20
Apr. 7, 1915	....	45.66	324.12
Apr. 20, 1915	....	45.17	324.61
Jan. 16, 1916	....	60.89	307.89
Mar. 17, 1916	....	44.95	324.83

No. 100. A. Andrade.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 28, 1916	371.91	57.47	314.44
Mar. 17, 1916	....	46.37	325.54

No. 101. J. Jones.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 28, 1916	373.27	59.63	313.64
Mar. 17, 1916	....	48.06	325.21

No. 102. E. S. Dyre.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 10, 1914	378.53	71.70	306.83
Jan. 14, 1915	....	67.66	310.81
June 14, 1914	....	92.00	....
Jan. 16, 1916	....	70.72	307.81
Mar. 17, 1916	....	53.10	325.43

No. 104. J. T. Higgins.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 10, 1914	382.43	73.40	309.03
Jan. 16, 1916	....	73.88	308.55
Mar. 17, 1916	....	55.79	326.64
Mar. 24, 1916	....	50.63	331.80

No. 105. E. J. Dubois.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 10, 1914	....	82.45	....
Nov. 30, 1914	....	82.92	....
Jan. 14, 1915	....	84.66	....
Feb. 18, 1915	....	81.00	....
Mar. 15, 1915	....	75.33	....

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
No. 106. J. O. Braden.			
Nov. 10, 1914	397.36	87.80	309.56
Jan. 28, 1916	....	84.20	313.16
Mar. 17, 1916	....	68.07	329.29
No. 107. G. Saccaggi.			
Jan. 28, 1916	397.62	83.32	314.30
Mar. 17, 1916	....	67.74	329.88
No. 108. C. De Sachy.			
Nov. 10, 1914	398.14	85.28	312.86
Mar. 17, 1916	....	65.05	333.09
No. 109. ———.			
Jan. 16, 1916	393.89	85.26	308.63
Jan. 28, 1916	....	81.20	312.69
Mar. 17, 1916	....	65.31	328.58
No. 111. M. E. Shirley.			
Nov. 10, 1914	....	114.85	....
Dec. 1, 1914	....	102.75	....
Jan. 16, 1915	....	106.00	....
Feb. 4, 1915	....	98.00	....
Feb. 25, 1915	....	103.66	....
No. 112. John L. Fisher.			
Nov. 10, 1914	....	93.27	....
Dec. 2, 1914	....	94.33	....
No. 114. John J. Nielsen.			
Nov. 9, 1914	....	81.00	....
Dec. 2, 1914	....	79.42	....
Jan. 12, 1915	....	67.00	....
Feb. 9, 1915	....	66.00	....
Feb. 27, 1915	....	62.00	....
Apr. 20, 1915	....	62.00	....
No. 115. F. Nielson.			
Jan. 26, 1915	373.19	67.50	305.69
Jan. 30, 1916	....	55.05	318.14
Mar. 17, 1916	....	44.11	329.08
No. 116. Levi Plavan.			
Jan. 30, 1916	375.61	39.42	336.19
Mar. 17, 1916	....	36.92	338.69

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
No. 117. G. Bettencourt.			
Jan. 30, 1916	378.65	50.18	328.47
Mar. 17, 1916	....	38.10	340.55
No. 118. John Hokawson.			
Jan. 30, 1916	385.60	72.12	313.48
Mar. 17, 1916	....	59.54	326.06
No. 120. R. F. Brady.			
Jan. 30, 1916	380.90	67.39	313.51
Mar. 17, 1916	....	54.54	326.36
No. 121. John Munson.			
Nov. 9, 1914	....	78.74	....
No. 124. L. Cunningham.			
Jan. 30, 1916	372.73	59.16	313.57
Mar. 17, 1916	....	50.24	322.49
No. 125. Road well.			
Nov. 9, 1914	373.88	67.67	306.21
Jan. 16, 1916	....	63.15	310.73
Jan. 30, 1916	....	46.20	327.74
Mar. 17, 1916	....	42.28	331.60
No. 126. S. F. Dowell.			
Jan. 30, 1916	364.30	50.29	314.01
Mar. 17, 1916	....	43.07	321.23
No. 127. C. E. Barnes.			
Jan. 30, 1916	366.98	53.12	313.86
Mar. 17, 1916	....	49.97	317.01
No. 128. W. A. Cunningham.			
Nov. 9, 1914	361.75	53.68	308.07
Dec. 6, 1914	....	54.83	306.92
Jan. 12, 1915	....	53.92	307.83
Feb. 9, 1915	....	56.00	305.75
Mar. 27, 1915	....	45.58	316.17
Jan. 30, 1916	....	37.63	324.12
Mar. 17, 1916	....	40.59	321.16

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 129. Mrs. Fowles.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 30, 1916	358.83	43.73	315.10
Mar. 17, 1916	....	36.00	322.83

No. 130. J. P. Knowlton.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 30, 1916	351.64	36.20	315.44
Mar. 17, 1916	....	30.00	321.64

No. 133. F. B. Bussing.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 7, 1914	343.32	38.98	304.34
Nov. 7, 1914	....	40.00	303.32
Dec. 12, 1914	....	44.58	298.74
Jan. 12, 1915	....	44.66	298.66
Feb. 6, 1915	....	40.58	302.74
Feb. 22, 1915	....	32.58	310.74
Mar. 2, 1915	....	30.42	312.90
Mar. 19, 1915	....	29.00	314.32
Apr. 2, 1915	....	28.83	314.49
Apr. 9, 1915	....	28.66	314.66
May 15, 1915	....	33.25	310.07
Feb. 3, 1916	....	27.82	315.50
Mar. 15, 1916	....	25.00	318.32

No. 134. Roy Hatch.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 7, 1914	347.37	41.98	305.39
Feb. 3, 1916	....	24.95	322.42
Mar. 15, 1916	....	26.76	320.61

No. 135. P. L. Lepera.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 7, 1914	348.32	43.81	304.51
Nov. 9, 1914	....	45.66	302.66
Jan. 10, 1915	....	48.58	299.74
Jan. 29, 1915	....	48.83	299.49
Feb. 26, 1915	....	36.58	311.74
Mar. 8, 1915	....	34.00	314.32

No. 136. B. Johnson.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 9, 1914	....	52.35	302.06
Jan. 14, 1915	....	49.50	304.91
Feb. 24, 1915	....	49.00	305.41
Mar. 26, 1915	....	33.10	321.31

No. 137. ———.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 3, 1916	354.41	35.90	318.51
Mar. 17, 1916	....	35.82	318.59

No. 138. H. R. Fulkner.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 3, 1916	355.46	39.80	315.60
Mar. 15, 1916	....	35.18	320.28

No. 139. W. J. Hatch.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 9, 1914	359.05	55.40	303.65
Jan. 9, 1915	....	53.00	306.05
Feb. 3, 1916	....	43.18	314.32
Mar. 15, 1916	....	38.24	320.81

No. 141. —— Jackson.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 30, 1916	361.27	48.72	312.55
Mar. 15, 1916	....	41.77	319.50

No. 143. William Hatch.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 3, 1916	350.51	35.74	314.77
Mar. 15, 1916	....	32.12	318.39

No. 144. Herbert Somers.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 16, 1916	357.73	53.26	304.47
Mar. 15, 1916	....	38.91	318.82

No. 145. F. G. Stocking.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 7, 1914	352.74	50.00	302.74
Jan. 16, 1916	....	49.07	303.67
Jan. 31, 1916	....	39.79	312.95
Mar. 15, 1916	....	34.18	318.56

No. 146. T. B. Wilkie.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 7, 1914	354.01	50.99	303.02
Jan. 31, 1916	....	41.89	312.12
Mar. 15, 1916	....	35.72	318.29

No. 149. Road well.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 9, 1914	361.21	60.58	300.63
Jan. 16, 1916	....	55.88	305.33
Jan. 30, 1916	....	47.00	314.21
Mar. 15, 1916	....	38.50	322.71

No. 150. Mrs. M. Rait.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 30, 1916	363.41	49.04	314.37
Mar. 15, 1916	....	41.70	321.71

No. 152. P. Locarnini.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 7, 1914	363.81	60.50	303.31
Dec. 10, 1914	....	60.17	303.64
Dec. 29, 1914	....	60.25	303.56
Jan. 30, 1915	....	65.00	298.81
Jan. 30, 1916	....	22.50	341.31
Mar. 15, 1916	....	29.55	334.26

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 153. Albert Hintz.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 7, 1914	365.23	62.15	303.08
Jan. 30, 1916	....	49.52	315.71
Mar. 15, 1916	....	40.30	314.93

No. 154. Tony Muchetto.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 7, 1914	355.39	55.90	299.49
Nov. 3, 1914	....	50.00	305.39
Jan. 31, 1916	....	41.52	313.87
Mar. 15, 1916	....	34.06	321.33

No. 156. James Castillou.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	342.27	49.00	293.27
Oct. 6, 1914	....	49.00	293.27
Nov. 10, 1914	....	52.00	290.27
Dec. 6, 1914	....	54.00	288.27
Jan. 11, 1915	....	52.00	290.27
Feb. 17, 1915	....	42.00	300.27
Mar. 30, 1915	....	42.00	300.27
Apr. 15, 1915	....	40.00	302.27
May 18, 1915	....	38.00	304.27
Jan. 31, 1916	....	39.35	302.92
Mar. 15, 1916	....	34.20	308.07

No. 158. M. S. Byers.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 31, 1916	345.28	33.65	311.63
Mar. 15, 1916	....	29.07	316.21

No. 159. T. Cathers.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 31, 1916	353.77	39.00	314.77
Mar. 15, 1916	....	33.67	320.10

No. 161. F. A. Lee.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 16, 1916	344.16	42.56	301.60
Mar. 15, 1916	....	28.26	315.90

No. 163. ———.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 5, 1916	340.53	25.60	314.93
Mar. 15, 1916	....	24.15	316.38

No. 164. Ahern & Schilling.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 5, 1916	338.29	24.08	314.21
Mar. 15, 1916	....	22.66	315.63

No. 165. Dr. Cheal.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 7, 1914	349.48	43.59	305.89
Feb. 3, 1916	....	30.75	318.73
Mar. 15, 1916	....	29.03	320.45

No. 169. A. Wheeler.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 16, 1916	327.06	20.53	306.53
Mar. 15, 1916	....	12.53	314.53
Mar. 24, 1916	....	12.94	314.12

No. 170. 21-Mile House.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 5, 1914	327.73	26.00	301.73
Feb. 5, 1916	....	13.78	313.95
Mar. 15, 1916	....	12.40	315.33

No. 171. F. Tremoureux.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 6, 1914	330.08	27.14	303.94
Feb. 5, 1916	....	13.80	316.28
Mar. 15, 1916	....	13.24	316.84

No. 172. Valentine Gardner.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 6, 1914	332.26	42.26	290.00
Nov. 15, 1914	....	33.50	298.76
Jan. 22, 1915	....	32.33	299.93
Jan. 27, 1915	....	32.50	299.76
Feb. 21, 1915	....	22.50	309.76
Feb. 24, 1915	....	21.33	310.93
Mar. 17, 1915	....	18.00	314.26
Mar. 21, 1915	....	19.00	313.26
Mar. 28, 1915	....	21.00	311.26
Apr. 16, 1915	....	19.58	312.68
May 17, 1915	....	18.50	313.76
Feb. 5, 1916	....	15.92	316.24
Mar. 15, 1916	....	13.10	319.16

No. 177. Road well.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 6, 1914	....	7.47	....
Mar. 15, 1916	....	1.92	....

No. 178. ———.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 6, 1914	....	7.73	....
Mar. 15, 1916	....	1.00	....

No. 179. ———.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 6, 1914	....	15.06	....

No. 180. A. Dauberg.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 6, 1914	....	13.45	....
Nov. 4, 1914	....	13.60	....
Jan. 14, 1915	....	10.83	....
Feb. 28, 1915	....	10.58	....
Feb. 24, 1915	....	8.92	....
Mar. 28, 1915	....	10.17	....

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 181. Mrs. John Patrone.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 6, 1914	....	13.45	....
Nov. 5, 1914	....	12.00	....

No. 184. John Douglas.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Sept. 1, 1914	....	35.00	....

No. 185. Road well.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Oct. 5, 1914	338.68	33.50	305.18
Feb. 2, 1916	....	16.52	322.16
Mar. 17, 1916	....	18.13	320.55

No. 186. J. M. Squibb.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Oct. 5, 1914	....	19.17	....
Dec. 4, 1914	....	19.17	....
Jan. 9, 1915	....	9.75	....
Jan. 29, 1915	....	8.83	....
Feb. 6, 1915	....	7.75	....
Feb. 20, 1915	....	7.70	....

No. 187. C. W. Stone.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Oct. 5, 1914	339.68	11.92	327.76
Nov. 3, 1914	....	13.10	326.58
Nov. 30, 1914	....	12.96	326.72
Jan. 9, 1915	....	12.39	326.29
Jan. 28, 1915	....	12.08	327.60
Feb. 8, 1915	....	9.60	330.08
Feb. 18, 1915	....	9.25	330.43
Feb. 24, 1915	....	9.33	330.35
Mar. 11, 1915	....	10.66	329.02
Mar. 19, 1915	....	11.25	328.43
Mar. 27, 1915	....	11.58	328.10
May 15, 1915	....	12.17	327.51
Feb. 2, 1916	....	9.00	330.68
Mar. 17, 1916	....	11.51	328.17

No. 188. Leonard-Coats Nursery.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Oct. 4, 1914	....	11.12	....

No. 189. Leonard-Coats Nursery.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Oct. 4, 1914	....	13.57	....

No. 190. G. L. Marvin.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Oct. 5, 1914	328.94	21.89	307.05
Dec. 1, 1914	....	23.25	305.69
Jan. 30, 1915	....	19.00	309.94
Feb. 7, 1915	....	11.00	317.94
Feb. 18, 1915	....	9.00	319.94
Feb. 2, 1916	....	8.02	320.92
Mar. 17, 1916	....	11.75	317.19

No. 191. J. C. McCloud.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Oct. 5, 1914	....	21.28	....
Nov. 5, 1914	....	24.00	....

No. 195. A. Mast.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Oct. 5, 1914	327.31	27.16	300.15
Feb. 2, 1916	....	12.80	314.51
Mar. 17, 1916	....	14.21	313.10

No. 197. Road well.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Feb. 2, 1916	319.23	7.26	311.97
Mar. 13, 1916	....	7.85	311.38

No. 198. E. J. Cunningham.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Oct. 5, 1914	318.02	20.94	297.08
Feb. 2, 1916	....	6.69	311.33
Mar. 13, 1916	....	8.10	309.92

No. 199. M. O. Ryan.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Oct. 5, 1914	314.99	16.62	298.37
Nov. 5, 1914	....	21.25	293.74
Feb. 4, 1915	....	8.50	306.49
Apr. 6, 1915	....	10.33	304.66
Feb. 2, 1916	....	3.45	311.54
Mar. 13, 1916	....	4.47	310.52

No. 200. A. Dahle.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Oct. 4, 1914	315.96	20.51	295.45
Nov. 3, 1914	....	19.00	296.96
Feb. 2, 1916	....	6.57	309.39
Mar. 13, 1916	....	8.32	307.64

No. 202. Road well.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Sept. 23, 1912	305.15	23.40	281.75
Oct. 4, 1914	....	15.77	289.38
Feb. 2, 1916	....	3.67	301.48
Mar. 13, 1916	....	5.55	299.60

No. 203. G. H. Du Bois.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Jan. 28, 1915	308.60	12.92	295.68
Mar. 8, 1915	....	6.50	302.10
Feb. 2, 1916	....	3.50	305.10
Mar. 13, 1916	....	5.26	303.34

No. 204. ———.

Date.	Elevation of bench mark	Depth to water	Elevation of water table
Jan. 31, 1916	307.17	4.20	302.97
Mar. 13, 1916	....	5.27	301.90

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 205. W. B. Steel.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 31, 1916	306.72	3.92	303.20
Mar. 13, 1916	....	4.36	302.36

No. 206. Road well.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1916	308.35	19.92	288.43
Aug. 1, 1914	....	17.00	291.35
Jan. 31, 1916	....	8.70	299.65
Mar. 13, 1916	....	9.16	299.19

No. 207. W. E. Bowman.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	309.00	21.06	287.94
Oct. 10, 1914	....	21.66	287.34
Nov. 9, 1914	....	22.83	286.17
Dec. 7, 1914	....	24.09	284.91
Jan. 18, 1915	....	23.66	285.34
Feb. 11, 1915	....	12.00	297.00
Feb. 24, 1915	....	10.50	298.50
Mar. 7, 1915	....	10.00	299.00
Mar. 20, 1915	....	10.50	298.50
Apr. 2, 1915	....	10.66	298.34
Apr. 19, 1915	....	10.83	298.17
Jan. 31, 1916	....	8.70	300.30
Mar. 13, 1916	....	11.05	297.95

No. 208. J. P. Seal.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	314.79	23.95	290.84
Oct. 6, 1914	....	25.50	289.29
Nov. 4, 1914	....	23.33	291.46
Dec. 1, 1914	....	23.33	291.46
Jan. 11, 1915	....	21.50	293.29
Jan. 28, 1915	....	22.66	292.13
Feb. 8, 1915	....	22.25	292.54
Feb. 17, 1915	....	22.00	292.79
Feb. 23, 1915	....	13.54	301.25
Mar. 8, 1915	....	16.00	298.79
Mar. 10, 1915	....	16.17	298.62
Mar. 23, 1915	....	13.00	301.79
Mar. 31, 1915	....	12.25	302.54
Apr. 14, 1915	....	12.66	302.13
May 15, 1915	....	13.42	301.37
Jan. 31, 1916	....	11.91	302.88
Mar. 14, 1916	....	12.05	302.64

No. 209. S. L. Harris.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	319.24	25.00	294.24
Jan. 31, 1916	....	15.74	303.50
Mar. 14, 1916	....	12.84	306.40

No. 210. ———.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	323.17	24.80	298.37
Jan. 31, 1916	....	13.31	309.86
Mar. 14, 1916	....	14.08	309.09

No. 211. J. S. Flinn.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 31, 1916	325.79	17.37	308.42
Mar. 14, 1916	....	15.95	309.84

No. 212. J. J. Golden.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	328.63	27.06	301.57
Oct. 10, 1914	....	27.92	300.71
Nov. 13, 1914	....	30.00	298.63
Dec. 5, 1914	....	31.50	297.13
Jan. 12, 1915	....	32.50	296.13
Jan. 30, 1915	....	30.58	298.05
Feb. 18, 1915	....	28.83	299.80
Mar. 1, 1915	....	27.25	301.38
Jan. 31, 1916	....	17.23	311.40

No. 213. Andrew Ross.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	327.81	38.29	289.52
Jan. 31, 1916	....	17.38	310.43
Mar. 14, 1916	....	16.18	311.63

No. 214. ———.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Jan. 31, 1916	320.61	12.90	307.71
Mar. 14, 1916	....	11.66	308.95

No. 215. G. Logan.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	315.52	20.60	294.92
Oct. 8, 1914	....	18.08	297.44
Nov. 5, 1914	....	19.50	296.02
Dec. 8, 1914	....	21.66	293.86
Jan. 10, 1915	....	23.38	292.14
Feb. 1, 1915	....	22.75	292.77
Feb. 18, 1915	....	10.25	305.27
Feb. 23, 1915	....	8.58	306.94
Mar. 8, 1915	....	7.08	308.44
Mar. 21, 1915	....	7.00	308.52
Mar. 31, 1915	....	7.00	308.52
Apr. 17, 1915	....	8.50	307.02
May 17, 1915	....	8.17	307.35
Feb. 2, 1916	....	7.36	308.16
Mar. 13, 1916	....	5.92	309.60

No. 216. Robert Westcott.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	310.99	21.59	289.40
Oct. 25, 1914	....	23.08	287.91
Feb. 15, 1915	....	8.33	302.66
Jan. 31, 1916	....	6.86	304.13
Mar. 13, 1916	....	6.92	304.07

No. 217. M. E. Hillman.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 28, 1914	352.64	57.94	294.70
Feb. 1, 1916	....	50.40	302.24
Mar. 13, 1916	....	61.45	291.19

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 218. E. H. Reignier.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 28, 1914	339.22	68.30	270.92
Oct. 21, 1914	....	60.25	278.97
Nov. 30, 1914	....	45.75	293.47
Jan. 25, 1915	....	30.33	308.89
Feb. 24, 1915	....	21.75	317.47
Feb. 1, 1916	....	61.78	277.44
Mar. 13, 1916	....	54.98	283.24

No. 219. ———.

Feb. 1, 1916	329.79	52.31	277.48
Mar. 13, 1916	....	45.27	284.52

No. 220. David Danyat.

Sept. 29, 1914	315.42	31.13	284.29
Dec. 2, 1914	....	28.33	287.09
Feb. 1, 1916	....	27.29	288.13
Mar. 14, 1916	....	22.32	293.10

No. 221. Frank H. Eberts.

Feb. 1, 1916	312.03	45.74	266.29
Mar. 13, 1916	....	30.39	281.64

No. 222. Frank Fultz.

Sept. 28, 1914	322.18	55.57	266.61
Feb. 1, 1916	....	44.16	278.02
Mar. 13, 1916	....	41.02	281.16

No. 223. W. C. Gwinn.

Sept. 28, 1914	....	58.00	....
Nov. 26, 1914	....	58.00	....

No. 224. William Eddy.

Sept. 29, 1914	312.18	47.37	264.81
Feb. 1, 1916	....	32.02	280.16
Mar. 13, 1916	....	26.80	285.38

No. 225. C. M. Van de Bogart.

Sept. 27, 1914	314.48	49.40	265.08
Feb. 1, 1916	....	44.28	270.20
Mar. 13, 1916	....	36.37	278.11

No. 226. B. C. Thiman.

Feb. 1, 1916	312.49	43.03	269.46
Mar. 13, 1916	....	35.82	277.67

No. 227. E. J. Rhodes.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Nov. 2, 1914	308.07	45.00	263.07
Feb. 1, 1916	....	41.93	266.14
Mar. 13, 1916	....	41.65	266.42

No. 228. L. H. Meigs.

Feb. 1, 1916	304.72	44.00	260.72
Mar. 13, 1916	....	38.06	266.66

No. 229. Road well.

Feb. 1, 1916	293.49	27.80	265.69
Mar. 14, 1916	....	24.77	268.72

No. 230. Dan McKeown.

Sept. 28, 1914	292.08	33.45	258.63
Dec. 13, 1914	....	44.50	247.58
Feb. 11, 1915	....	26.00	266.08
Feb. 1, 1916	....	23.50	268.58
Mar. 14, 1916	....	22.33	269.75

No. 231. W. D. Griffin.

Sept. 28, 1914	287.37	27.58	259.79
Feb. 1, 1916	....	16.66	270.71
Mar. 14, 1916	....	16.23	271.14

No. 232. P. Dethlefson.

Feb. 1, 1916	285.23	15.27	269.96
Mar. 15, 1916	....	14.77	270.46

No. 233. B. F. Brown.

Sept. 29, 1914	275.90	16.53	259.37
Feb. 1, 1916	....	6.56	269.34
Mar. 15, 1916	....	6.14	269.76

No. 234. S. W. Kinney.

Sept. 29, 1914	....	29.83	....
Dec. 2, 1914	....	34.33	....

No. 235. W. B. Jackson.

Sept. 29, 1914	289.20	16.90	272.30
Nov. 29, 1914	....	19.75	269.45
Feb. 1, 1915	....	10.33	278.87
Mar. 14, 1916	....	10.90	278.30

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 236. Frank Kennedy.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	290.06	24.26	265.80
Jan. 30, 1915	....	23.00	267.06
Feb. 1, 1915	....	13.72	276.34
Mar. 14, 1916	....	13.57	276.49

No. 237. L. Perkins.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	293.85	19.34	274.51
Oct. 6, 1914	....	19.33	274.52
Nov. 6, 1914	....	16.54	277.31
Dec. 12, 1914	....	16.83	277.02
Jan. 17, 1915	....	14.80	279.05
Feb. 1, 1916	....	6.32	287.53
Mar. 14, 1916	....	6.90	286.95

No. 238. F. M. Byerly.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	301.08	19.80	281.28
Oct. 15, 1914	....	18.00	283.08
Nov. 4, 1914	....	23.00	278.08
Dec. 7, 1914	....	24.00	277.08
Feb. 2, 1915	....	16.00	285.08
Feb. 19, 1915	....	10.00	291.08
Mar. 10, 1915	....	9.00	292.08
Apr. 16, 1915	....	13.00	288.08
Feb. 2, 1916	....	6.02	295.06
Mar. 14, 1916	....	7.32	293.76

No. 239. E. P. Pope.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 1, 1916	303.12	6.97	296.15
Mar. 14, 1916	....	7.90	295.22

No. 240. H. Robinson.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	308.30	21.68	286.62
Oct. 15, 1914	....	22.42	285.88
Nov. 3, 1914	....	28.92	279.38
Dec. 5, 1914	....	25.83	282.47
Jan. 11, 1915	....	25.00	283.30
Jan. 27, 1915	....	23.00	285.30
Feb. 17, 1915	....	11.50	296.80
Feb. 23, 1915	....	10.33	297.97
Mar. 9, 1915	....	10.00	298.30
Mar. 26, 1915	....	11.17	297.13
Mar. 30, 1915	....	11.00	297.30
May 16, 1915	....	10.00	298.30
Jan. 31, 1916	....	8.78	299.52
Mar. 13, 1916	....	9.23	299.07
Mar. 16, 1916	....	9.35	298.95

No. 241. R. McGlashan.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	....	23.82	....
Oct. 14, 1914	....	24.00	....
Nov. 11, 1914	....	24.00	....
Mar. 29, 1915	....	12.00	....

No. 242. ———.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 2, 1916	300.29	5.07	295.22
Mar. 14, 1916	....	5.82	294.47

No. 243. E. D. Valliant.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	....	15.00	....

No. 244. John Wickman.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 2, 1916	297.46	3.45	294.01
Mar. 14, 1916	....	5.04	292.42

No. 245. John Schubert.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Feb. 1, 1916	296.39	4.48	291.91
Mar. 14, 1916	....	5.44	290.85

No. 246. E. Herback.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	295.01	24.46	270.55
Oct. 30, 1914	....	22.66	272.35
Dec. 12, 1914	....	18.66	276.35
Feb. 1, 1915	....	9.66	285.35
Feb. 23, 1915	....	4.17	290.84
Mar. 27, 1915	....	4.92	290.09
Apr. 18, 1915	....	5.08	289.93
Feb. 2, 1916	....	3.75	291.26
Mar. 14, 1916	....	4.65	290.36

No. 247. W. B. Trumbull.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	294.50	22.70	271.80
Oct. 6, 1914	....	21.92	272.58
Nov. 3, 1914	....	23.30	271.20
Dec. 2, 1914	....	25.17	269.33
Jan. 11, 1915	....	23.00	271.50
Jan. 29, 1915	....	19.00	275.50
Feb. 6, 1915	....	14.46	280.04
Feb. 20, 1915	....	11.38	283.12
Feb. 23, 1915	....	10.80	283.70
Mar. 7, 1915	....	10.66	283.84
Mar. 22, 1915	....	11.33	283.17
Mar. 28, 1915	....	10.80	283.70
Apr. 20, 1915	....	12.54	281.96
May 16, 1915	....	11.30	283.20
Feb. 2, 1916	....	10.98	283.52
Mar. 14, 1916	....	11.67	282.83

No. 248. George Pitchford.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	....	18.55	....
Oct. 6, 1914	....	18.92	....
Nov. 4, 1914	....	20.83	....
Dec. 2, 1914	....	23.66	....
Jan. 9, 1915	....	14.50	....
Jan. 28, 1915	....	5.83	....
Feb. 8, 1915	....	3.50	....
Feb. 17, 1915	....	3.25	....
Feb. 26, 1915	....	3.66	....

Water levels in wells in the vicinity of Morgan Hill, Cal.—Continued.

No. 248. George Pitchford—Continued.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Mar. 11, 1915	....	4.17	....
Mar. 23, 1915	....	4.66	....
Mar. 30, 1915	....	4.42	....
Apr. 20, 1915	....	4.83	....
May 15, 1915	....	4.58	....

No. 249. Enos Bechis.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	290.17	18.76	271.41
Oct. 6, 1914	....	19.38	270.79
Nov. 3, 1914	....	20.50	269.67
Nov. 30, 1914	....	22.83	267.34
Jan. 11, 1915	....	16.42	273.75
Jan. 27, 1915	....	14.00	276.17
Feb. 6, 1915	....	12.66	277.51
Feb. 18, 1915	....	7.83	282.34
Feb. 24, 1915	....	7.66	282.51
Mar. 8, 1915	....	8.75	281.42
Mar. 20, 1915	....	8.92	281.25
Mar. 27, 1915	....	9.50	280.67
Apr. 16, 1915	....	8.50	281.67
May 17, 1915	....	7.58	282.59
Feb. 2, 1916	....	7.87	282.30
Mar. 14, 1916	....	8.68	281.49

No. 250. Adolph Petrick.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 27, 1914	283.34	19.55	263.79
Oct. 7, 1914	....	19.66	263.68
Nov. 9, 1914	....	21.00	262.34
Dec. 5, 1914	....	25.00	258.34
Feb. 6, 1915	....	12.50	270.84
Feb. 17, 1915	....	9.42	273.92
Mar. 10, 1915	....	8.75	274.59
Mar. 28, 1915	....	12.00	271.34
Apr. 16, 1915	....	13.00	270.34
Feb. 2, 1916	....	9.03	274.31
Mar. 14, 1916	....	9.68	273.66

No. 251. C. Mangels.

Date.	Elevation of bench mark at mouth of well (feet above sea level).	Depth to water in well (feet below bench mark).	Elevation of water table (feet above sea level).
Sept. 29, 1914	....	23.63	....
Nov. 5, 1914	....	27.08	....
Dec. 2, 1914	....	28.54	....
Jan. 9, 1915	....	24.42	....
Jan. 27, 1915	....	13.17	....
Feb. 17, 1915	....	7.33	....
Mar. 4, 1915	....	6.17	....
Mar. 22, 1915	....	6.83	....
Apr. 16, 1915	....	7.00	....

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