STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
BEFORE THE STATE ENGINEER AND
CHIEF OF THE DIVISION OF WATER RESOURCES

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In the Matter of Application 14569 by Bertha H. Himes and Estate of Isaac A. Himes to Appropriate Water from Mojave River in San Bernardino County for Domestic and Irrigation Purposes.

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Decision A 14569 D 830

Decided May 20, 1955

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Appearances at Hearing Held at Los Angeles on May 17, 1954:

For the Applicants

I. A. Himes*)
)
Bertha H. Himes) Conrad E. Mahlum
Attorney at Law

For the Protestants

Milton C. Culver)
)
Sidney Smith) Marcus Muskat
Attorney at Law

EXAMINER - LESLIE C. JOPSON, Principal Hydraulic Engineer, Division of Water Resources, Department of Public Works, for A. D. EDMONSTON, State Engineer.

Also present - Max Bookman, Principal Hydraulic Engineer, and J. J. Heacock, Senior Hydraulic Engineer, Division of Water Resources, Department of Public Works.

* Since deceased.

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OPINION

General Description of the Project

The application initiates an appropriation of 34 cubic feet per second plus 475 acre-feet per annum from Mojave River, in San Bernardino County, for domestic purposes and irrigation. The water is to be diverted at a point within the SW¼ NW¼ of Section 13, T11N R6E, SBB&M; it is to be utilized in irrigating a total of 1,320 acres of pasture occupying portions of Sections 17, 18, 19, 20, 29, 30 and 33 of T12N R7E, SBB&M, and in serving the domestic needs of personnel operating the development. Diversion according to the application is to be effected "by pumping from wells and by gravity by virtue of underground dike constructed of concrete"; conveyance by some 30,000 lineal feet of earth canal (with clay bottom) of a stated capacity of 45 cubic feet per second. The projected works include two earth dams. One of these is to be 18 feet high by 3,600 feet long, the other 20 feet high by 5,300 feet long. They are to create respectively a 240 acre-foot reservoir near the southeast corner of Section 30 and a 235 acre-foot reservoir near the south quarter corner of Section 17, T12N R7E, SBB&M. Of the 1,320 acres to be irrigated the applicants claim to own 720 acres and to have filed a desert entry claim upon the remainder. According to the application irrigation is to extend throughout the year; the land to be irrigated is said to have no other water right or source of water supply.

Protests

The application is protested by one Milton C. Culver and by one Sidney Smith.

Protestant Culver apprehends that the development that the applicants propose will lower the water table and thereby destroy range feed. He states "This stream is the main source ... from which we pump for livestock and domestic use". As to the extent of present and past use he states:

> "This has been a working cattle ranch since 1932, and prior to this date was a small portion of another ranch."

His protest also contains the following statement:

> "For the last fifteen years the water table has been dropping, the last five of which has been dropping rapidly. Since this is semi-arid land and the rainfall is exceedingly light, we depend immensely on the river to replenish our supply. This river, at the western end and through the canyon, feeds a large area of natural grasses and desert willows. Since this water has been diverted into an open ditch by the said Mr. Himes two years ago, the above mentioned feed has been set back and in some cases died completely. I feel that this situation should not be allowed to continue."

By letter dated July 4, 1953, Protestant Culver supplemented his protest by reporting that the wells upon which he depends for stock-watering are located as follows: one well each within Section 6 of T11N R8E, Section 18 of T11N R9E, Sections 14, 15 and 28 of T12N R8E, Section 33 of T12N R9E; and two wells within Section 35 of T12N R8E. In the same letter he mentions dependence also upon waters in Afton

Canyon and states

> "At the present time we are carrying one hundred head of cattle plus calves. The usual capacity is from two hundred fifty to three hundred."

Protestant Smith states in his protest as follows:

> " ... if this application is approved and the appropriation is made it will divert the surface and sub-surface flow of water supplying my wells, stockwatering places and sub-irrigated land, all included within and on the real property ... belonging to the undersigned. That this protestant has been using the source and flow of water from which applicant proposes to appropriate for twenty years last past, for the aforesaid purposes and uses."
>
> "That the flow of said water is riparian to Protestant's said land and further Protestant has openly, continuously and under a claim of right used said water for twenty years last past."
>
> "That the real property ... embraces a total of 1023.83 acres. That Protestant has been using during said 20 years between 4 and $4\frac{1}{2}$ acre-feet of water on each of said 1023.83 acres, in growing and raising mesquite, salt grass, desert willows, Russian thistle, sage brush, browse and natural grasses for cattle and stock feed and pasture."
>
> "This protest may be disregarded and dismissed if it can be shown and established that the said application to appropriate will not interfere, lessen or diminish any of my water arising on and being used on the real property ...."

Protestant Smith describes his property as being located within Sections 7, 17 and 18 of T11N R8E; Section 20 of T12N R7E; Sections 35 and 36 of T12N R8E; and Sections 19 and 30 of T12N R9E.

Answers

Extracts from the applicants' answer to the Culver protest are as follows:

> "To the best of my information and belief, the granting of this application will in no way divert surface and sub-surface water to lands of Protestant."

"To the best of Applicant's information and belief, Protestant obtains his water from Soda Lake ... ten miles from applicant's point of diversion. Applicant does not believe that the granting of this application ... would in any manner affect the Protestant's water supply."

"Regarding the open ditch presently maintained by Applicant the presence and maintenance of this ditch in no way affects Protestant's land or water level. This ditch has taken only the natural flow of water during the winter time which would have flowed on Applicant's property in any event; that the water flowing into this ditch does not come within ten miles of Protestant's property at any time and has absolutely no effect on Protestant's land or water level."

The applicants state in answer to the Smith protest as follows:

"To the best of my information and belief, the granting of this application will not divert the surface and sub-surface flow of water to the lands of Protestant. The only parcels belonging to Protestant which are adjoining the river are those parcels located in Section 20. The balance of the property, a long time ago, was in the river flood wash; that said parcels possibly received some water during extreme flood conditions many years ago, but since 1918, when the United States government constructed a large dike upriver from Applicant's property even flood waters have been drawn into Cronese District, thereby taking even the flood waters from Protestant's property."

"Protestant has conducted no irrigation whatsoever upon his lands and has at no time made any beneficial use of the water sought to be appropriated by Applicant. It is the belief of this Applicant that Protestant's water level would not be affected by ... this application as Protestant's water comes from Soda Lake, this lake water-level being very constant; that the granting of this application would in no manner affect the Soda Lake water level. Regarding Protestant's land located in Section 20, Applicant would still get the same amount of water to these lands if the application herein is granted; that due to the dike heretofore mentioned the granting of this application would in no way affect the balance of Protestant's property."

Hearing Held in Accordance with Water Code

Application 14569 was completed in accordance with the Water Code and the Rules and Regulations of the Division of Water Resources and being protested was set for public hearing under the provisions of the California Administrative Code, Title 23, Waters, on Monday, May 17, 1954, at 1:30 o'clock p.m., in Room 803, California State Building, Los Angeles, California. Of the hearing the applicants and the protestants were duly notified.

Substance of Hearing Testimony

I. A. Himes (one of the original applicants) testified (pages 7 to 27 of transcript) to the effect that there is a dam at the site of proposed Reservoir No. 2, that the dam is incomplete, that there was a complete dam there at one time, that he believes it washed away in the flood of 1937 or 1938, that it was used to impound water for irrigation, that the location marked Reservoir No. 3 is the location at which he intends to catch flood waters, that water has never before been stored at that site, that at the proposed point of diversion on Mojave River he plans to construct an underground dike extending to bedrock, that bedrock is 6 feet below the ground surface, that the dike is to extend upward to within 2 feet of the ground surface, that the purpose of this dike is to divert water into a pipe line of steel and concrete, 20 inches

or more in diameter, that he has "been around the Cronese Valley and Afton area" for about 20 years, that his proposed point of diversion is in Afton Canyon, that about a mile upstream from the point of diversion a fault intersects the river, that some of the river bed follows the fault, that under flood conditions "the water goes into the Cronese and then it goes out over the flats toward Crucero," that the water he is seeking to appropriate is wanted for agricultural purposes and stockwatering, that at present he has 250 acres under cultivation, that no other lands in Cronese Valley are under cultivation, that he has a well in Section 17 and another in Section 19, that the wells are 250 feet deep, that ground water rises to within 22 feet of the ground surface, that "we go through 93 feet of blue clay to get to the water", that the water upon which he has filed is not being used, that its appropriation by him would not injure anyone else, that there are no wells that he knows of within 6 miles of his proposed point of diversion, that there is another dike located downstream from his proposed point of diversion, that it is used as a road and was built during the war presumably for flood protection, that the effect of that dike is to divert flood waters into Cronese Valley, that before the dike was built Mojave River flood waters discharged partly into Soda Lake, partly into Cronese Valley, that the dike prevents any of the flow of Mojave River from reaching the Soda Lake area, that cattle graze in the vicinity of the proposed point of diversion, that there

are no operating ranches between his proposed point of diversion and the Cady Ranch, or on Soda Lake. Witness Himes testified further (pages 28 to 54 of transcript) to the effect that he started farming operations within his project area 2½ years ago, that he is diverting water from Mojave River, that he irrigates about 100 acres from the river, also that he is pumping from two wells, that the capacity of one is 65 inches and of the other 110 inches, that the wells irrigate 160 acres planted to cotton.

Kenneth Volk, Consulting Civil Engineer, tesfified (pages 55 to 81 of transcript)to the effect that he spentApril 10 and 11, 1954, on and around the applicants' proposed works, that he did not observe the dike referred to in Witness Himes' testimony, that from his experience he would not anticipate any dike there but that heavy boulders might be mistaken for bedrock, that he observed surface flow issuing from Afton Canyon, flowing thence to the northeast and disappearing, that there was grass and foliage along the banks immediately above the applicant's point of diversion, that in his opinion the present flow and any limited flows would pass into East Cronese but that large surface flows would divide, part going into Cronese, part into Soda Lake, that there was foliage immediately below the mouth of the canyon, that he observed vegetation on both sides of the railroad between Rasor and Crucero, that a submerged dam built at the proposed point of diversion on Mojave River would cause underflow at that point

to rise to the surface, that diversion as proposed by the applicant is feasible but would probably be expensive, that he (the witness) did not observe any fault within a mile of the proposed point of diversion, that a low dam at the point of diversion would probably wash away, that Mojave River Wash is formed by heavy floods, that there are no wells in the vicinity of the point of diversion, that he observed the water level in certain wells in Cronese Valley, also certain wells near Rasor and near Crucero, that he did not taste the water, that the construction of a dam at the proposed point of diversion would have some minor effect upon water levels in those wells.

Leo Smith testified (pages 83 to 91 of transcript) to the effect that he is interested in some land in the Soda Lake area, that the land includes 288 acres of deeded land and 70,000 acres of leased land, that the land lies west of Soda Lake and east of the applicant's point of diversion, that he has had this land for a number of years, that he has used it for grazing cattle, that none of it has been cultivated, that the natural vegetation is dependent upon the water table, underground flow, winter overflow and rainfall, that dearth of rainfall in recent years has hurt annuals but has not hurt perennials very much, that he last grazed cattle in that area in 1952, that the cattle were 160 in number, that desert willow, mesquite and salt grass get water principally by subirrigation, that fewer cattle have been grazed in recent years because rainfall has been scantier and groundwater levels lower.

Sidney Smith testified (pages 91 to 106 of transcript) to the effect that he has been running cattle for 20 years, that he has been familiar with the Soda Lake region since 1903, that cattle eat desert willow, mesquite, salt grass, sage and various grasses, that such vegetation is supported by subirrigation, that cattle are in that area throughout the year, that dikes were built by railroads in 1910, 1916 and 1938 for flood protection, that flood waters spread out for great distances, that the effect of the dikes was to divert flood waters "into Cronese", that the latest heavy flood was in 1938, that in his opinion any artificial blocking off of subsurface water would reduce the supply for subirrigation of the lands upon which he and others graze cattle, that such lands would become less valuable or valueless, that at present he is running cattle only on the Camp Cady Range in T10N R3 and 4E, that he last ran cattle below Afton Canyon in 1950, that he never irrigated in the Soda Lake area because subirrigation sufficed, that he knows of no fault at the place mentioned by the applicant.

Other Available Information

Supplementing the hearing a field investigation was made on May 26, 1954, jointly by an engineer and a geologist, both of the Division. At the hearing it had been stipulated (page 106 of transcript) in effect by the parties' attorneys that the report of a field investigation conducted in the presence of Mr. Smith by personnel of

the Division including a recognized geologist would have the weight of evidence. Extracts from the report of the investigation that was conducted are as follows:

> "The time set was 8 o'clock a.m., Wednesday, May 26, 1954, at Proctor's Service Station in Cronese Valley. Sidney Smith ... arrived about 8:30 a.m. and Mr. Himes ... about 2:30 p.m. ...."

> "During the morning, Afton Canyon was traversed from its mouth in Section 13, T11N R7E, SBB&M, to the U.S.G.S. recorder station in the SE¼ of Section 18, T11N R6E. Stream flow measurements were made and surface water samples were collected at the Afton recorder station and at the spur track trestle in the NW¼ of Section 13, T11N R7E, near the mouth of the canyon."

> "During the afternoon, Fox, Himes and Sidney Smith inspected the area near the proposed point of diversion, and Lee Smith and the writer (J. J. Heacock) visited some of the protestants' wells. Mr. W. L. Burnham of the U.S.G.S. Ground Water Section, was met at the Rasor wells, and he furnished some useful information concerning ground water levels and quality of water."

> "Data concerning physical features and water supply of the area can be found in U.S.G.S. Water Supply Paper 578, on pages 509, et seq., and also in Division of Water Resources Bulletin No. 47, 'Mojave River Investigation, 1934'."

> "The (geological) investigation consisted of a geologic reconnaissance of the area and interview with the applicant, Mr. I. A. Himes, and with Mr. Sidney Smith, the protestant."

> "The Mojave River, which debouches into the basin containing Soda Lake, is responsible for the formation of Afton Canyon. The canyon has a predominant east-west trend and is bounded on the north by Cave Mountain and on the south by the Cady Mountains. Cave Mountain has been uplifted along an east-west trending fault which lies approximately one mile north of the river."

"There are seven units exposed within the area tributary to the area under investigation (Recent Alluvium, Sand Dunes, Lake Deposits, Older Sediments, Volcanics, Crystalline Complex, Paleozoic Rocks)."

"The Recent Alluvium is the principal aquifer within the area. The older sediments may transmit water but are less permeable than the alluvium. The crystalline rocks are essentially nonwater-bearing with the exception of water that occurs in fractured zones. The Mojave River upon leaving Afton Canyon enters a broad alluvial plain. Surface flow at this point would normally move in an easterly direction toward Soda Lake but has been diverted. Before 1917, the Los Angeles and Salt Lake Railroad Company constructed a levee, which has subsequently been destroyed, that deflected surface water in a northeasterly direction in order to protect the railroad bed from flood flow damage."

"After the disastrous flood of 1938 when the original levee was destroyed, the Union Pacific Railroad Company constructed a second levee .... This levee also was built to deflect surface water northeasterly."

"The Tonopah and Tidewater Railroad Company also built artificial barriers .... These barriers are in the form of small dikes which are from one-fourth to one-half mile in length and five or six feet in height. These levees have deflected surface flows in the Mojave until water now flows in a northeasterly direction and enters Cronese Lake basin in the vicinity of East Cronese Lake. In the case of almost all the desert basins, subsurface water moves in a direction which coincides with the slope of the bedrock floor upon which the permeable sediments have been deposited. When a basin is of the internally draining type the formation of a playa results since the playa covers an area within the basin where the water table is closest to the surface. Soda Lake basin is of this type and it too includes a playa. It is, therefore, logical to state that underflow when leaving Afton Canyon flows in an easterly direction toward Soda Lake. Apparently very little subsurface movement of water is in a northerly direction through the gap which separates Soda Lake basin from East Cronese basin. A geologic inspection of this gap showed that bedrock lies close to the surface and is overlain by not more than 10 feet of sediments. Bedrock thus forms an impermeable barrier to the movement of water through this gap."

"Afton Canyon is flanked on the north and south by mountains composed of nonwater-bearing rocks. These mountains are cut by several faults which act as effective ground-water barriers and transect Afton Canyon. Where these faults cross the canyon it is marked by areas of rising waters and dense growths of vegetation."

"A geologic inspection conducted by R. C. Fox in the company of Mr. Himes at the proposed point of diversion failed to reveal any evidence of a zone of faulting or displacement of the rock south of the main channel opposite the proposed point of diversion."

"At the time of the investigation, (surface) flow was measured at the Afton Recorder Station at about 0.9 cubic foot per second, and about 0.17 cubic foot per second near the mouth of the canyon. Thence the flow was turned northerly toward East Cronese Lake by the railroad levee and disappeared in the sands in the NW¼ of Section 6, T11N R7E."

"No data are available on production and drawdown of wells in the area, so definite conclusions of sources of supply cannot be made. Precipitation in the area averages less than five inches per year, so it is logical to assume that water for recharging the underground basins is mostly from the Mojave River."

"The location of the proposed diversion dam, as indicated to Fox by Himes, lies over one-half mile upstream from the location given in the application."

"The testimony of Lee Smith, that the mesquite easterly from the mouth of the canyon is more verdant than that toward Cronese Valley, is valid."

"The ground elevations given for the wells are determined either by altimeter or picked from the contours, so reliable gradient profiles of ground-water elevations cannot be drawn."

The report covering the field investigation of May 26, 1954 was supplemented by a memorandum dated April 18, 1955, containing opinions by the same investigators, as follows:

"The construction of a submerged dam at the proposed point of diversion would interfere with the protestants'

water supply in the vicinity of Soda Lake. A pipe line from the dam to Cronese would interfere with natural surface flow of the Mojave River toward Soda Lake. The Mojave River constitutes the major source of supply of water for the Soda Lake area."

Mojave River, according to maps of the region, rises on the northerly slopes of San Bernardino Mountains, flows northerly some 65 miles to the vicinity of Barstow, thence easterly some 50 miles to the vicinity of Baxter (on Union Pacific Railroad). At or near Baxter the river emerges from a canyon onto an expanse of gently sloping, open terrain. When flow is excessive the river traverses this expanse, its flow extending to Soda Lake (some 15 miles easterly of Baxter) and, very exceptionally, to Silver Lake (north of Soda Lake). Ordinarily however, surface flow is little or nothing below the emergence of the river from the hills.

The flow of Mojave River has been measured at various points above Barstow, at Barstow and, for a brief period, at Afton. Afton scales about 45 miles down-river from Barstow; it is about 5 miles up-river from Baxter. Mean flows passing the points of measurement at Barstow and near Afton are reported in Water Supply Papers, United States Geological Survey, to have been as tabulated below.

MOJAVE RIVER AT BARSTOW

Mean Flows in Cubic Feet per Second

Water-year	November	December	January	February	March	April	May	June	Water-year Mean
1930-31	0	0	0	0	0	0	0	0	0
31-32	0	0	0	457	162	66.2	1.71	0	55.5
32-33	0	0	22.7	24.1	56.1	20.9	8.55	0.10	11.0
33-34	0	5.35	56.7	6.5	3.9	0.27	0	0	6.12
34-35	0	0	0	0	0	19.9	0	0	1.64
35-36	0	0	0	57.6	6.31	25.8	0.49	0	7.25
36-37	0	0	0	534.	770.	383.	66.0	0	143.0
37-38	0	0	0	0	1962.	230.	61.7	0	191.0
38-39	0	0	0	0	0.17	9.07	0	0	0.76
39-40	0	0	0	0	0	0	0	0	0
1940-41	0	0	0	222.	738.	547.	93.5	0	133.0
41-42	0	0	0	0.5	1.0	0.2	0	0	0.14
42-43	0	0	492.	281.	601.	131.	6.19	0	126.0
43-44	0	0	0	0	318.0	177.	19.0	0	49.9
44-45	0	0	0	55.2	187.	125.	1.27	0	30.5
45-46	0	2.98	0	0	61.0	145.	0	0	17.4
46-47	4.3	31.2	10.8	0.42	.19	0	0	0	3.97
47-48	0	0	0	0	0	0	0	0	0
48-49	0	0	0	0	0	0	0	0	0
49-50	0	0	0	0	0	0	0	0	0
1950-51	0	0	0	0	0	0	0	0	0
51-52	0	0	1.98	0	20.8	164.	22.1	0	17.3

N. B. - Mean flow over 22-year period approximately 36.1 cubic feet per second. No flow of record during any month of July, August, September or October.

MOJAVE RIVER AT AFTON

Mean Flows in Cubic Feet per Second

Water-year	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Water-year mean
1929-30				1.89	1.67	1.66	1.32	1.33	0.95	0.63	0.60	0.87	
30-31	1.40	1.72	1.84	1.92	1.94	1.90	2.05	1.80	1.44	1.05	0.81	0.76	1.55
31-32	1.19	1.91	1.97	2.09	113.0	11.4	1.94	1.09	.53	.22	.26	.47	10.8

Division Bulletin No. 47 — "Mojave River Investigation" (1934) -- contains statements as follows:

"Below the Forks (some 55 miles up-river from Barstow) the course of the stream is north ... then northeastward ... then eastward ... to Soda Lake and finally northward 15 miles to Silver Lake. Surface contributions are negligible below the Forks but some underflow can be detected ... reaching the stream below ... Victorville (40 miles up-river from Barstow)."

"Below Baxter (0.5 mile below the applicants' proposed point of diversion) there is a broad debris cone which is very absorptive. The stream flow at this point, which occurs only during very infrequent floods, wanders over this debris cone on which it splits into two divergent channels, one channel carrying water northerly into East or Upper Cronese Valley where a lake has been formed and at the northerly end of which overflow through a low gap would carry the water to another basin known as West or Lower Cronese Valley. The other channel carries the water easterly onto Soda Lake, a broad alkali flat which offers no surface storage, but over which the flood flow spreads for a considerable area, saturating the soil from which it later evaporates. At the lower end of Soda Lake the remaining flow regathers and passes through a low pressure gap into Silver Lake .... There is direct evidence that Silver Lake has overflowed during recent times in which case the water would reach the Amargosa River ...."

"Although there are small contributions by underflow possibly as far east as Harvard (some 25 miles below Barstow) ... the stream begins to lose water as soon as it leaves the mountains, by evaporation, percolation into the streambed ... and transpiration from vegetation along its course, and only the larger floods find their way into the lakes ... where the waters are finally evaporated."

"At no place along the stream is the water table distant below the streambed .... Along most of the course the water table is so close to the surface that a growth of cottonwood is maintained and in some places tules, willows, etc. At frequent intervals along the bed a small surface stream is found where the underflow has been forced to the surface."

"Study ... indicates that in the 29-year period beginning 1905-06 there were probably 16 years in which no flood discharge past Afton occurred."

"Flood waste must have occurred in large quantities in only 8 of the 29 years ...."

" ... when the necessities of existing ... developments are considered and also the (presently) unused legal rights to water involved, the situation is extremely complex."

Water Supply Paper No. 578, United States Geological Survey (1929), contains among other statements the following:

"At Baxter (Cave Canyon) ends and the river emerges onto a plain that slopes eastward and northeastward. The plain is an alluvial fan built by the river."

"In the last few years at least the flood waters have mostly flowed northeastward ...."

"The valley lies from about 925 to 1,225 feet above sea level ...."

"The only large discharge (of surface water) comes when heavy floods descend the river from the headwater region. At such times ... flood waters pour into Soda Lake playa."

"There has not been sufficient pumping in the valley to show whether the water table will fluctuate greatly if there is much irrigation. As long as the river floods reach the valley the recharge will doubtless be sufficient to provide for irrigation .... If however the flood waters are stored in the headwater region ... the supply for recharge will be greatly decreased and may become exhausted."

"Samples from several wells and springs were analyzed .... These analyses show considerable differences ... in the water in the different parts of the valley. The total dissolved solids range from 371 to 3,129 parts per million. Some of the samples are very bad if not unfit for domestic use."

"The best water ... is a sodium carbonate water .... It is good for domestic use but poor for irrigation."

" ... determinations (of temperature of well water) show a range between $50\frac{1}{4}^{o}$ and $78\frac{1}{2}^{o}$."

" ... floods from Mohave River cross the valley every two or three years or oftener."

A report by the Bureau of Reclamation, United States Department of the Interior, entitled "Report on Victor Project, California", April 1952, contains statements as follows:

"It (the report) presents the results of an investigation in the Mojave River Basin ... to determine if an irrigation project could be developed. From a combination of adverse circumstances ... the report finds the Victor Project unfavorable ...."

"The project lies in the Mojave River Basin .... The Mojave River rises in the San Bernardino Mountains, flows ... a distance of about 110 miles where it disappears in Soda Lake, a dry lake .... For most of this distance the ordinary flow is underground. In a few places the flow is brought to the surface by ... formations which divide the trough of the valley into a series of underground reservoir basins. Pumping from the underground basins now furnishes nearly all of the irrigation water used ...."

"The water supply considered to be available ... would be the long-time annual inflow to the area (90,800 acre-feet) less the amount consumed annually by native vegetation, by domestic and industrial uses, and lost by evaporation and seepage outflow (subtotal 40,600 acre-feet) and less an undetermined amount which must be released from the area to maintain a favorable salt balance. Not to exceed 50,000 acre-feet could be considered available for irrigation."

"In 1940 an area of about 7,000 acres was irrigated ... by diversion ... and by pumping .... In 1946 ... 8,500 acres. By 1951 ... 17,940 .... The weighted average consumptive use of irrigation water by crops ... evaluated ... was 3.12 acre-feet of water per acre. At this rate the 17,940 acres irrigated would consume 56,000 acre-feet .... This amount is to be compared with the 50,000 acre-feet, gross, available. The amount ... consumed in 1950 therefore exceeded the long-time annual flow available, a situation which if continued would portend the continual lowering of the ground-water level."

"But in addition to the presently irrigated acreage, other lands under their riparian rights and correlative rights to ground water could legally demand, and are so situated topographically, that they can share in the present water supply. The present supply cannot adequately irrigate all the ... land which has a legal entitlement; to obtain a firm irrigation supply for irrigation development would require that water be imported ....

"The value of Afton as a point of measurement stems from the fact that it is downstream from all irrigated areas. Discharge past that point (includes) possible salvageable waste ...."

" ... the riparian acreage was estimated to be at least 59,000 acres. This area extends ... to a point ... about 15 miles west of Afton ...."

"The annual recharge of the river comes principally from ... the headwater area. Surface inflow other than from the headwater area is negligible."

"The seepage outflow at Afton is the only known water escaping from the area excepting flood flows."

"In water year 1930-31 there was no surface flow at Barstow and the flow at Afton was 1,120 acre-feet. Observations ... indicate ... this amount is ... representative of the mean annual drainage outflow. In water year 1931-32 the total flow at Barstow was 40,300 acre-feet and the total discharge past Afton was 7,910 acre-feet, 1,120 acre-feet of which is assumed as seepage flow and 6,790 acre-feet as flood flow. Examination of the daily discharge sheets for Barstow and Afton for water year 1931-32 shows generally that little or no flood flow occurred at Afton when the flow at Barstow fell to 200 second-feet or below. The total discharge past Barstow in water year 1931-32, excluding the discharge resulting from flows of 200 second-feet or lower, was 29,074 acre-feet. Thus the flood discharge of 6,790 acre-feet past Afton was about 23 percent of the 29,074 acre-feet discharge past Barstow. Applying this 23 percent ratio to annual Barstow discharges resulting from flows exceeding 200 second-feet, for the 21 years for which we have Barstow records, gives an annual average flood waste of 5,300 acre-feet at Afton or a total annual average outflow from the basin of 6,400 acre-feet. See Table 8."

"Table 8", referred to in the last quoted paragraph of the Bureau of Reclamation report is entitled "Computation of Estimated Annual Flood Waste Past Afton". The first and last columns of "Table 8" are as follows:

Water Year	Estimated discharge at Afton. 23 percent of Barstow flows in excess of 200 second-feet (acre-feet)
1930-1931	0
1931-1932	6,790*
1932-1933	0
1933-1934	0
1934-1935	90
1935-1936	0
1936-1937	22,120
1937-1938	30,920
1938-1939	0
1939-1940	0
1940-1941	21,050
1941-1942	0
1942-1943	18,510
1943-1944	6,610
1944-1945	2,670
1945-1946	2,270
1946-1947	310
1947-1948	0
1948-1949	0
1949-1950	0
1950-1951	0
Total for 21 years	111,340
Mean annual	5,302
Say	5,300

*Recorded measurement

Discussion

In the absence of indications of significant gains or losses between Afton and the applicants' proposed point of diversion some 5 miles farther downstream it may be supposed that outflows passing those two points are substantially the same. Outflow, according to the Bureau of Reclamation report quoted in part in preceding paragraphs, includes both intermittent and widely variable surface flow and underflow which is relatively steady. In the 21 water years considered in the report surface flow was estimated as ranging between extremes of zero and 30,920 acre-feet and averaging about 5,300 acre-feet per annum; underflow as holding quite steadily to a rate of 1,120 acre-feet per annum. The report thus indicates that the gross yield of Mojave River at the point where the applicants seek to appropriate averages approximately 5,300 plus 1,120 or 6,420 acre-feet per annum and may amount in a single year to anything from about 1,120 to about 1,120 plus 30,900 or 32,020 (or more) acre-feet.

The diversion by the applicant of the entire underflow may not be an easy matter, necessitating as it does a water tight dam extending down to bedrock. Whereas the applicant believes bedrock is but 6 feet below ground surface Witness Volk, a qualified engineer, intimates in his testimony that the hard material at shallow depth may be merely an accumulation of boulders and that a dam to arrest the underflow may have to be extended to a much greater depth than 6 feet. It may be presumed that the applicants will not commit themselves to construction costs if they find that those costs will outweigh resulting benefits.

The appropriation sought by the applicants could amount to 365 x 34 x 1.98 plus 475 or nearly 25,000 acre-feet per annum, an excessive amount for the irrigation of 1,320 acres. It is improbable that a right could be perfected to more than, say, 5 acre-feet per acre or 6,600 acre-feet in all, per annum. Under the assumptions of the Bureau of Reclamation study no surface flow at all would have reached the applicants' proposed point of diversion during 11 of the 21 water years considered in that study; surface flows of 6,600 acre-feet or more would have reached that point in but 6 years. Even in those 6 years the applicants could not have diverted all the water that reached their proposed point of diversion because of the limited capacity of any diversion conduit that would be likely to be installed.

Surface flows which might have been diverted at rates not exceeding 45 cubic feet per second -- the capacity of the conduit proposed in the application -- appear in the light of the available data to be somewhat as shown in the last column of a following tabulation, the figures of that column being the differences between the corresponding figures of the two columns that just precede it.

Water-year	Period during which surface flow occurred	Estimated surface flow (acre-feet)	*Flow in excess of diversion canal capacity (acre-feet)	*Flow that might have been diverted (acre-feet)	(per cent)
1930-31		0	0	0	
31-32	2/ 9 - 3/ 5	6,790	4,470	2,320	33.2
32-33		0	0	0	
33-34		0	0	0	
34-35	4/10 - 4/11	90	0	90	100
35-36		0	0	0	
36-37	2/ 7 - 5/ 2	22,120	16,060	6,060	27.4
37-38	3/ 1 - 5/ 5	30,920	25,480	5,440	17.6
38-39		0		0	
39-40		0		0	
1940-41	2/21 - 5/ 4	21,050	14,720	6,330	30.1
41-42		0		0	
42-43	1/23 - 3/28	18,510	14,770	3,740	20.2
43-44	2/23 - 4/29	6,610	3,050	3,560	53.8
44-45	2/ 3 - 4/11	2,670	1,420	1,250	46.8
45-46	3/31 - 4/ 6	2,270	1,650	620	27.3
46-47	12/28 - 12/29	310	130	180	58.0
47-48		0		0	
48-49		0		0	
49-50		0		0	
1950-51		0		0	
Total		111,340	81,750	29,590	
Average		5,302	3,893	1,409	26.6

* Diversion canal capacity assumed to be 45 cubic feet per second.

The situation appears to be that a firm underground flow of some 1,120 acre-feet per annum normally exists, that surface flow occurred in 10 out of a certain 21 years, that such flow occurred during those years not earlier than December 28 nor later than May 5, ranged from zero to 30,920 and averaged 5,302 acre-feet, and that diversion

facilities of a capacity of 45 cubic feet per second would have diverted percentages of annual flow ranging from 17.6 in a flood year to 100 in years of lesser flow and, over the 21 years considered, averaging 26.6.

The outflow of Mojave River, while intermittent and widely variable in amount, nevertheless appears to be the main source of supply to the arid area lying to the east and northeast from the emergence of the river from the mountains. Stock raisers, according to the hearing testimony, depend upon it for the support of vegetation upon which their cattle graze and for the replenishment of underground storage from which stockwatering supplies are drawn. The vegetation in particular appears sensitive to even minor fluctuations of ground-water level because, according to the testimony, it subirrigates. The protestants assert, and no evidence is offered by the applicants or is otherwise at hand to refute their assertion, that the stock-raising potential of their lands would be seriously impaired by the diversion that the applicants propose. The hydrographic data indicate that the applicants' proposed diversion would substantially reduce outflow from Mojave River. It is evident that any substantial diversion at or near the point proposed would lower somewhat the water table underlying the protestants' lands. The evidence in fact suggests that no portion of the flow of Mojave River within the reach under discussion warrants consideration as appropriable.

Conclusion

The available information points to the conclusion that the flow of Mojave River at the point at which the applicants seek to appropriate is ordinarily needed in its entirety to maintain ground-water levels beneath lands to which it naturally finds its way and that unappropriated water at that point is therefore ordinarily non-existent. In view of that conclusion it is the opinion of this office that Application 14569 should be denied.

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ORDER

Application 14569 having been filed with the Division of Water Resources as above stated, protests having been filed, a hearing having been held and the State Engineer now being fully informed in the premises:

IT IS HEREBY ORDERED that Application 14569 be rejected and canceled upon the records of the Division of Water Resources.

WITNESS my hand and the seal of the Department of Public Works of the State of California this 20th day of May, 1955.

A. D. Edmonston
State Engineer