

See DWR Bulletin 63
Seawater Intrusion

1-18-66

BUDGET 1966-67 (TENTATIVE)

HISTORY

PROPOSED WATER WELLS

AT

MARINE & 16th STREETS (MARINE STREET PARK)
SANTA MONICA

date

Unpublished
City Memo

INTRODUCTION:

With the ever increasing cost to Santa Monica for imported water from the State Water Project and the Colorado River water via M.W.D. facilities (page 3) and the apparent policy of the City to pump more water from its natural resources within the limit (?) of the proposed softening plant at Arcadia Pumping Station, there exists a potential water supply at the Marine Street Park (Santa Monica Water Basin).

The finding or developing of future water producing wells has a certain amount of investment risk. What degree of investment risk could not be calculated because geology and ground water hydrology are not an exact science - one might go so far as to say, "Ground water is where you find it". However, in the interest of future savings to the City by not importing as much water with the ever increasing rate to the water consumer, it certainly should be worth some investment risk. Therefore, in this interest we should like to report our findings and recommendations concerning this subject. In order for a policy determination to be made, we are of the opinion that the following material should be presented, along with the U. S. Geological Survey map of the bay area showing drainage areas-known and questionable, fault lines, tentative location for a proposed water transmission line, etc.

1. Metropolitan Water District Imported Water Cost:

In 1960 the voters of California authorized the necessary bond money for the State Water Project (Borus-Porter Act). As you know, the population of the Metropolitan Water District of Southern

see Conc by Tom Bailey
on p. 9

GW production p. 4 here
also * p. 11/12

A here

California is now 9,500,00 (half the population of the state) and is expected to double that number within 25 years. To meet the tremendous new demand for water, and taking into consideration the recent adverse decision of the Supreme Court ruling concerning water rights from the Colorado River, the Metropolitan Water District found it necessary to contract with the State of California for the delivery of 2,000,000 acre-feet of water a year, or 1.8 billion gallons a day from the State Water Project.

While the District is only one of some thirty contractors for State Project water, it is far the largest since it will bear approximately two-thirds of the total capital costs to be paid the state by all contractors. In addition to this cost, the District finds it necessary to enlarge its system for the distribution of state water, which will cost an estimated six billion dollars in the next 75 years.

The state water delivered to the South will cost approximately \$70-75 per acre-foot and while the Colorado River water only costs \$20 per acre-foot delivered via M.W.D. facilities (prior to the Supreme Court action), the District has found it necessary to increase the cost of water to its member agencies (118 cities in Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura Counties). The District chose the composite rate plan rather than the separate rate plan in selling water, and as a result the cost of water from M.W.D. is as follows:

here

Date	Cost/Acre-foot	Tax Rate/\$100	Tax S.M.	% Vote M.W.D.
Prior to 1954	\$20	25¢	\$347,713.73	2.29%
July, 1957	22	18¢	346,374.04	1.70%
July, 1958	23	18¢	365,644.92	1.68%
July, 1961	25	15¢	327,993.77	1.45%
1962	27	14¢	299,854.30	1.35%
1963	29	14¢	295,802.66	1.29%
1964	34	14¢	347,498.12	1.40%
1965	37	14¢	357,712.75	1.33%
1966	40	1969 - \$49		
		1970 - \$52		
1967	43	1971 - \$55		
		1972 - \$58		
1968	46	1973 - \$61		
		1974 - \$64		
19	57	1975 - \$67		
		1985 - \$64		
		1986 - \$61		
		1987-1990 \$58		

*early-
m 1966*

2. Water Consumption, City of Santa Monica:

The City of Santa Monica Water Division serves approximately 88,000 people through 15,500 water services. The water consumers use approximately 14,500 to 15,000 acre-feet of water per year.

From 1951 (the year the City of Santa Monica joined the Metropolitan Water District) to 1958, it was the policy of the City to take all imported water (MWD Colorado River water) for distribution to its consumers. The 1958 bond issue provided the necessary facilities for taking well water from Charnock, and in the interest of assuring a water right to the Charnock Water Basin and of economy of operation, the Water Division started pumping well water from its wells at Charnock.

On July 26, 1963, the City Attorney ruled "That the City of Santa Monica should pump from the Charnock Basin the maximum safe limit of the basin, and that if a softening plant were required, we would be better advised to expend monies therefor than to risk any loss of our rights in the Charnock Basin.

The foregoing, of course, applies with equal force to pumping operations at the Arcadia Pumping Plant."

The following water production and imported water records are submitted in order to show the percentage of well water pumped from 1958 to date.

WATER CONSUMPTION
IN ACRE-FEET

Year	Total Consumption	MWD Imported	Charnock	Arcadia	Percent Well Water
1958	14,379	13,654	279	446	5%
1959	15,154	12,990	1,693	471	14%
1960	14,335	10,887	2,998	450	24% <i>Water Div. started pumping well water due to increase cost of MWD Imported water & Water Rights @ Charnock</i>
1961	14,339	11,002	3,100	237	23%
1962	14,176	10,626	3,546	4	25%
1963	14,368	10,591	3,777	0	26%
1964	14,994	10,914	3,734	349	27%
1965	15,164	10,484	3,720	960	31%

NOTE: 15,000 acre-feet/year = 4,888,000,000 gallons, or approx. 41 acre-feet/day, or 13.39 million gallons/day.

1970 15,800
1975 16,600
1980 17,200
1985 18,100
1990 18,700

Amount well water pumped, during this period depends on;

1. Water Softening plant
2. Water Rights @ Charnock
3. Availability of well water in S.M. Basin
4. City Policy.

at 10 million gallons

3. Proposed Softening Plant at Arcadia:

The water softening plant at the Arcadia Pumping Station will have a design capacity of five and one-half million gallons per day (16.8 A.F./day) with possible maximum operation capacity of approximately eight million gallons per day (24.5 A.F./day). The cost of processing water through the softening plant will be approximately \$7.01/A.F. when operating at 4.5 million gallons/day; \$6.18/A.F. when operating at 5.5 million gallons/day; \$5.64/A.F. when operating at 6.5 million gallons/day; \$5.23/A.F. when operating at 7.5 million gallons/day; and \$4.92 when operating at 8.5 million gallons/day, according to the depreciation table presented by James M. Montgomery Consulting Engineers, Inc. (revised due to increased capacity).

The plant will be located at the Arcadia Pumping Station, 1228 South Bundy Drive, Los Angeles, since it is the operations center of the Water Division Production Section. The operating and maintenance employees spend approximately 90% of their time at this site. The Arcadia Pumping Station, which is centrally located, receives water from the Arcadia and Charnock wells, terminus of the MWD-Santa Monica Feeder, and other wells which may be developed. All of these items of consideration together will permit the Water Division to operate the softening plant much more economically at the Arcadis site than at any other location.

4. Natural Water Resources:

A. Charnock: The City of Santa Monica has pumped water from the Charnock Basin since September, 1924, and was the original party in the taking of water from this basin (presumably based on recommendation by Olmstead & Gillelen in 1923). The Southern

California Water Company started pumping from the Charnock Basin in March, 1931. The following tabulation illustrates the amount of water pumped from this basin by the two major parties (no record of the amount of water produced by the City of Santa Monica exists from the year 1924 to 1931).

WATER PRODUCTION
in acre feet by

CITY OF SANTA MONICA AND SOUTHERN CALIFORNIA WATER COMPANY

Year	(A) SOUTHERN SEPULVEDA WELLS	(B) CALIFORNIA CHARNOCK WELLS	(C) WATER SANTA MONICA WELLS	(D) TOTAL S.C.W.C.	SANTA MONICA	TOTAL
1931	853	3,575	-	4,428	2,496	6,924
1932	390	3,148	-	3,538	4,288	7,826
1933	449	2,643	-	3,092	4,283	7,375
1934	678	2,181	-	2,859	4,969	7,828
1935	1,012	1,850	-	2,862	5,036	7,898
1936	312	1,825	-	2,637	5,456	8,103
1937	362	2,430	-	3,342	5,609	8,951
1938	919	2,395	-	3,314	5,969	9,283
1939	1,253	2,297	-	3,555	6,552	10,107
1940	1,293	2,222	-	3,520	6,969	10,489
1941	1,125	2,686	-	3,811	3,446	7,257
1942	1,121	2,458	-	3,579	47	3,626
1943	1,335	3,399	-	4,734	11	4,745
1944	1,396	3,718	-	5,114	19	5,133
1945	1,773	3,932	719	6,424	-	5,724
1946	1,834	4,356	633	6,823	-	6,578
1947	1,822 1323	4,460 same	1,576 1543	7,360	-	7,360
1948	1,200 same	4,926 same	2,481 2468	8,607	-	8,607
1949	1,256 1255	4,310 4309	3,404 3388	8,970	-	8,970
1950	1,425 same	4,791 4792	2,534 3744	8,750	-	8,750
1951	1,287 986	5,269 same	1,857 4560	8,113	-	8,113
1952	1,280 same	2,367 same	-	3,247	-	3,247
1953	1,401 402	3,233 3234	-	3,634	1 same	3,635
1954	1,548 549	3,060 same	-	3,608	54 "	3,662
1955	1,310 309	3,001 "	-	3,311	288 "	3,599
1956	1,402 401	3,236 "	-	3,638	271 "	3,909
1957	1,508 same	3,504 "	-	4,012	319 "	4,331
1958	1,353 352	2,452 2451	-	2,805	279 "	3,084
1959	1,13 same	504 503	-	517	1,693 1646	2,210
1960	1,7 same	834 same	-	841	2,998 same	3,839
1961	- "	676 "	-	676	3,100 "	3,776
1962	- "	765 "	-	765	3,546 "	4,311
1963	- "	698 "	-	698	3,777 3778	4,475
1964	-	-	-	-	-	-
TOTALS	25,577	22,251	13,411	114,979	25,746	203,725
AVERAGE	353	2,826	1,916	4,007	2,859	6,173
VE. for TOTAL	775	2,826	406	4,007	2,166	6,173

$$D = A + B + C$$

City
SM
ΣQ

Reported by City of Santa Monica
(Charnock wells only)

Charnock wells only

The third party (only other known producer from this basin) is the Fox Hills Country Club (Home Savings & Loan Association), and it is estimated that they are producing approximately 400 acre-feet per year. It is also our understanding that they are presently subdividing approximately one-fourth of their country club ground area. It is possible that the City of Santa Monica and the Southern California Water Company could acquire this water right (if any has been legally established) as they reduce their production (due to future rumored subdivision, if any).

It is probably obvious at this point that the Charnock Basin has not been legally adjudicated. In fact, the City of Santa Monica and the Southern California Water Company discussed a potential agreement for the water basin management and the water rights each party apparently had in the basin. Negotiations with Southern California Water Company were stopped when the City Attorney ruled, "---that it is neither proper nor desirable to enter into this agreement or to join in a report at this time".

The United States Department of Interior in its Geological Survey Water Supply Paper #1461 made a study of the Charnock Ground Water Basin in 1959. In this study, they described the so-called water barrier faults, to the east it is the Overland Avenue Fault, and to the west it is the Charnock Fault (see attached map). The study indicates that approximately two-thirds of the water supply comes from the north drainage area and approximately one-third of the water supply comes from the south drainage area. The study further indicates that the basin apparently has a safe yield of approximately 7,000 A.F./year (2,280,880,000 gallons per year, or 6,248,986 gallons per day, or 19.2 A.F./day).

The southern drainage area as outlined in yellow on the attached map has been bisected by the north boundary of the adjudicated West Basin (Superior Court of the State of California No. 506806- see Report of Referee dated June 1952).

NOTE

The Overland Avenue Fault may possibly be receiving water from the Beverly Hills Basin (see Page 163 Geological Survey Water Supply Paper #1461).

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The Southern California Water Company has limited its production since 1959 from the Charnock Basin, due to the fact that Culver City joined the M.W.D. and forced the Southern California Water Company to serve its consumers nothing but M.W.D. water. Southern California Water Company has informed us that they plan to construct a water softening plant at their Charnock wells, depending upon a rate increase grant from the California Public Utilities Commission.

B. Santa Monica Water Basin (includes the Arcadia Wells?):

The only known water yield estimate is on Page 163 of the Geological Survey Water Supply Paper #1461. It states:

"The coastal area apparently receives almost all its replenishment from the Santa Monica upland to the north and by direct infiltration of rainwater in Ballona Gap. Through the thirties, when water levels stood below sea level, it also received substantial recharge from the ocean. For the past two decades no replenishment has moved westward across the Charnock Fault. In fact, with the great differential in water levels that has existed across the Charnock Fault since the late twenties, some

X

GW barrier
-8-

water probably has moved inland across the fault.

"The draft in the coastal area in the forties is estimated to have been between 2,000 and 3,000 acre-feet per year."

Bulletin No. 104, Appendix "B", Page 117, of the Department of Resources, State of California, combines the Charnock Basin and what we call the Santa Monica Basin and call it the Santa Monica Basin. It states, "The actual amount of seasonal ground water extraction that occurred in 1957 in the Santa Monica Basin was about 6,100 acre/feet. Assuming this extraction to have occurred during each year of the base period, the seasonal amount of ground water safe yield for the Santa Monica Basin under the fixed 1957 conditions would have been only 100 acre-feet".

NOTE

The City of Santa Monica, as a result of the Water Resources Bulletin No. 104 statement on Page 80, "The upper division or upper member of the Pico formation as a potential source of ground water", and Dr. Thomas L. Bailey's statement (consulting geologist) of recommendation "that a 1,000 foot test hole be drilled at Arcadia), drilled a test hole at Arcadia to a depth of 596 feet in 1963. From a depth of 175 feet to 596 feet, blue clay and silt (probably marine deposits with no water) were discovered. As a result, Dr. Bailey stated, "The drilling to date (the 596 ft. test hole) proves that the San Pedro deeper aquifer that produces in your Charnock wells is missing on the Arcadia Pumping Station property and that it is unlikely that promising deeper aquifers exist under this part of Santa Monica or vicinity". From this observation plus the water levels reported from four wells (two on the west side of the Charnock fault and two on the east side of the Charnock Fault (see attached map), it has been proved that:

(1) The Charnock fault is a fairly effective water barrier; and

(2) There exist two distinct separate water basins from the Overland Avenue Fault west - namely the Charnock Basin and the Santa Monica Basin.

This fairly well establishes the geological findings of the Department of Interior Paper #1461, but in turn does not establish much weighted value to the Department of Water Resources Bulletin No. 104 geological theory.

However, this does not mean to imply that the forebay water or return water from approximately Santa Monica Blvd. north and northwest cannot travel to some degree to either the Charnock or Santa Monica Basin, depending upon water levels in the respective basins, porosity, depth of aquifer, undiscovered faults or barriers, etc. These aspects could only be established by expensive sample drillings and/or radioactive isotope sampling and are valueless until such time that legal proceedings involving water rights find it to be a requirement for fair and proper adjudication by the court.

The City of Santa Monica at one time had water wells at the Marine Street Park (formerly called the Hatch Street Water Plant) and the City or private water companies serving the City of Santa Monica had water wells in the Santa Monica Canyon.

The Water Division has found a map apparently prepared by a John A. Morton, City Engineer, showing a 3.47 acre tract in the Santa Monica Canyon and showing thereon some water wells and also has

physical evidence of a transmission line at 7th Street and San Vicente Place South. No record can be found as to the amount of water production from the Santa Monica Canyon Plant.

The wells at Marine Street Park (Hatch Street Park) produced from date unknown to approximately 1937, at which time the wells became contaminated with salt water and they were abandoned. A report by Olmstead & Gillelen (of which we do not have a copy, but we have Plate 7 of that report), shows that in October, 1923 production was in excess of 7 acre-feet per day (approximately 2.4 million gallons of water per day). A map prepared by a F. C. Finkle, Consulting Engineer, Los Angeles, California, which we estimate was prepared somewhere around 1924, shows approximately 60 wells which were in production in the Santa Monica Basin. See p. 17

The only known water wells in production in the Santa Monica Basin at this time are the Arcadia wells (approximately 3 acre-feet per day) and a well owned by a farmer in the Venice area which we presume would not produce over one acre-foot per day. In the latter case, we think it safe to assume that the subject property has become too expensive for farming and that production from this well will stop when the farm land is subdivided.

The following shows the production from the Hatch Street Plant (Marine Street Park) of record:

**MARINE STREET
PRODUCTION RECORD**

additional pumping
NOTE by City

Year	MG/Year	MG/Day	Water Level from Ground Level	Source
1917	240±	0.66±	22	Plate 6, Olmstead & Gillelen
1918	220±	0.6±	23	"
1919	250±	0.67±	30	"
1920	400±	1.1±	40	"
1921	420±	1.15±	45	"
1922	420	1.15±	42	"
1923,)	Oct. 25	2.32±		Plate 7, Olmstead & Gillelen
	NO RECORD			
1933)	272	0.75±	NO RECORD	Pumpage Records
1934	246	0.68±		"
1935	253	0.7±		"
1936	279	0.76±		"
1937	275	0.75±		"
1938	266	0.74±		"
1939	314	0.86±		"
1940	307	0.84±		"
1941	Water used on the golf course (M. B. Gentillon indicated the water got too hard to use).			

NOTE: Caspar Winiger indicates that up to 1940-41 the area south of Santa Monica to Ballona Creek was all farms and that the Japanese farmers all had wells for irrigation.

In checking with Mr. Eugene C. Ramstedt, Assistant Civil Engineer, Engineer Planning Branch, Southern District, Department of Water Resources, we find their sampling of water wells (none producing) indicates that salt water contamination in the Santa Monica Basin has receded to the point of approximately Lincoln and Culver Blvds. west to the ocean (see attached map).

In the Water Division's attempt to find salt water under the beach, nothing but fresh water was encountered from a point opposite California Avenue to the north and to a point opposite Pacific St. to the south. Apparently 4th St. hill is partially stopping the ground water movement to the ocean. When the City Council authorized the five exploratory holes throughout Santa Monica, it was found that at the Marine Street Park (Hatch Street Pumping Plant) the salt water had apparently been flushed out of this area, from a sample of the water produced. Also, this program revealed that sand and gravel strata are available at 26th and La Mesa, 19th and San Vicente, Palisades Ave. approximately 100 ft. south of 7th St., 7th and San Vicente, and Cloverfield and Olympic. The water obtained from these test holes varied from 240 to 514 parts per million hardness, 0.02 to 0.17 parts per million in iron, 8.1 to 8.55 in pH, and the results are tabulated below:

history

history

CHEMICAL
WATER SAMPLE
RESULTS
WATER TEST HOLE PROGRAM

Hole Number, Location and Depth	Ground Elevation	Depth of Sample	pH	Iron PPM	Hardness PPM	Approx. Static Water Level
No. 1 - 19th & San Vicente 350'	315'	no sample				20-22'
No. 2 - 26th & La Mesa 300'	370'	165'	8.55	.02	514	10-12
No. 3 - 7th & San Vicente 400'	210'	120'	mud- no water recovered			10-15
No. 4 - Palisades Ave. near 7th 400'	162'	105' 300'	No water 8.5	.17	240	20
No. 5 - Marine St. & 16th 400'	20'	120'	8.1	.04	463	14-18
No. 6 - Cloverfield & Olympic 400'	150'	220'	8.5	.04	360	60

As a result of the exploratory holes, Dr. Bailey recommended that the City drill a well at 19th St. and San Vicente Blvd., and 26th St. and La Mesa Drive, and that the City redrill wells at the Marine Street Park.

In the fiscal year 1965-66, the Council authorized a well at 19th and San Vicente, and with Council's authority drilling will start approximately February, 1966. The reason the Water Division wants to drill this well at this versus a probably more abundant supply from Marine Street Park is:

- (1) An attempt to build up a prescriptive right on the water which is available in the Santa Monica Canyon; and
- (2) To determine water levels under continuous pumping conditions in an attempt to learn more about what we have called the Santa Monica Basin and its relation to existing and future Santa Monica City wells within the Santa Monica Basin.

At this point, reference is made to the attached map, on which it is noted that Area 1 equals approximately 9,190 acres and Area 2 equals approximately 6,640 acres, for a total of 15,830 acres. Note on Page 7 of this report that the U. S. G. S. Survey Water Paper #1461 makes an estimate of 7,000 A.F./year as an approximate safe yield. *for SAMB(?)*

In our preliminary investigations of the Charnock Basin with the Southern California Water Company, only Area 1 was considered to be supplying water to the Charnock Basin. (Since Southern California Water Company is a party of the West Coast Basin adjudication, the reason why Area 1 was the only area of consideration is obvious.)

Six different studies were made of Area 1 based on the historic yield, and a final weighted average annual yield of 6,841 acre-feet was obtained. Further studies, based strictly on rainfall and area (method of determining permissible pumping by calculating rainfall and area on a year to year basis), indicate a variation of from 14 inches of rain for 5,500 acre-feet permissible pumping for the year to 22 inches of rain for 8,750 acre-feet permissible pumping for the year.

The two preceding studies ignored so-called direct return water (irrigation water, i.e. sprinkling of lawns, all of which add to the percolation of water to the underground aquifers) and this water is adding considerable to our ground water resources. It might also be interesting to note that the courts have ruled on diverted return water but the author knows of no court decisions concerning direct return water to a forebay feeding a water basin or to the water basin underlying direct return water.

Notice Area 3, which contains approximately 15,000 acres, is about equal to the acreage contained in Areas 1 and 2. The rainfall is about equal. Would it not then be logical to conclude that the two areas should produce about the same amount of water if underground water could be produced for beneficial use prior to reaching the ocean! This, of course, does not imply that the capacity or size of the underground basin is equal. The questionable faults in the Santa Monica Basin apparently did not adversely affect the pumping from Marine Street Park in previous years.

The Southern California Water Company at one time pumped from the Santa Monica Basin, but apparently discontinued this practice when Venice became a part of Los Angeles City and was then served by the Los Angeles Department of Water & Power. No contact has been made with Southern California Water Company concerning their wells in the Santa Monica Basin for apparent reasons.

Based on economic considerations let us assume, for the sake of argument and pending future findings, that the Santa Monica Basin safe yield is approximately two million gallons per day (see page 8), that since the City has a water softening plant (under construction?), that the basic policy of the City Council is to treat and soften

all well water produced, and that the City does not desire to install additional water facilities which would create more positions within the Water Division. From these basic assumptions, if they are correct, we can then compute the price of well water from Marine Street Park to and through the Arcadia water softening plant and thence to the reservoirs and distribution system in the 350' pressure zone (it is necessary to pump the assumed amount of water from Marine Street Park wells to the 350' pressure zone since the present production from Charnock and Arcadia will satisfy the average consumer demand in the 250' pressure zone).

Under the above assumptions, the cost of Marine Street well water is:

a. Electrical energy cost/acre foot from wells to Arcadia Pumping Station	\$ 6.00
b. Water wells (2 each) depreciation cost per acre-foot - life expectancy 27.8 years	1.48
c. Pumps & Misc. Equipment Depreciation cost per acre-foot - life expectancy 10 yrs.	2.90
d. Twelve (12) inch diameter transmission line from Marine Street wells to Arcadia Softening Plant (approx. 18,800 lin. ft.) depreciation rate/acre-foot - life expectancy 64 years (City Controller's rate)	4.47
e. Maintenance of wells - City forces and contract, estimated @	0.25
f. Softening plant costs/A.F. @ 6.5 M.G./day	5.64
g. Chlorine gas cost per A.F.	0.44
h. Electrical energy cost from Arcadia to the 350' pressure zone	<u>2.50</u>
Total cost per acre-foot	\$23.68

If the above estimated cost of Santa Monica Basin water taken from Marine Street Park is compared with the present and future cost of imported water, we have:

Date	Imported Water Cost per Acre-foot	Cost of Marine Street Water	Difference	Amount Pumped from Marine St./yr.-acre-feet minus 5% for shutdowns	Approx. Savings per Year
1965	\$37	\$23.68	\$13.50	2131	\$28,000.00
1966	40	"	16.50		35,000.00
1967	43	"	19.50		41,000.00
1968	46	"	22.50		47,000.00
19__?Est. 57	57	"	33.50		71,000.00

Total estimated (1966) cost for Marine Street water wells with water transmission line to the Arcadia softening plant, assuming a two million gallon/day production, is:

a. Wells and Pumps	\$70,000.00
b. 12-inch water transmission line	<u>282,000.00</u>
Estimated Total Cost	\$352,000.00

For information, the present saving on well water produced in the calendar year 1965 is approximately:

a. Power Cost (Electrical Energy):

Site	Amount Well Water Produced		Cost/A.F.	Power Cost
	Gallons	Acre-feet		
Charnock:	1,201,373,000	3688	\$ 5.20	\$19,165.00
Arcadia:				
Wells	298,034,448	915	2.31	8,761.00
Boosters	935,636,000	2872		

b. Chemical Treatment:

Water Chemist & Chemical Laboratory

@ \$12,000 x 50%

\$ 6,000.00

Caustic Soda & Chlorine \$3800

c. Depreciation Remedial Treatment Plant:

\$35,000 - 20 yrs.

1,750.00

Approx. Total Cost to Procure 4603 A.F.
or approx. \$7.75/acre-foot

\$ 35,676.00

d. Cost for M.W.D. Imported Water (1965)

4603 A.F. x \$37.00/A.F.

\$170,311.00

Savings without softening

\$134,635.00

e. When the water softening plant is
constructed, the cost of Arendia and
Charnock well water for the same
quantity of water will be increased by

\$ 32,267.00

Savings with softening

\$102,368.00

RECOMMENDATION:

If the final decision (policy) of the City is not to take more underground water from the Charnock Basin than we are presently producing, then based on the summary presented, we propose that the City budget in the 1966-67 fiscal year the drilling of two water wells at Marine Street Park (formerly Water Division Hatch Street Plant) and one observation well at Ozone Park near 7th St.

The observation well (8 to 12 diameter) water would be analyzed periodically, at least once a month during the summer and fall months. If the chloride content should rise significantly, the pumping at Marine Street Park would be reduced so as to prevent sea water intrusion - providing the sea water moves in from the west. Immediately to the south and southwest is the City of Los Angeles and it is not considered feasible nor politically possible to construct an observation well in this direction.

In the search for more natural water resources within the City of Santa Monica, we visualize the following basic program:

1. The 1966-67 budget would grant the Water Division funds for the drilling of the recommended wells. The Water Division would then program the drilling of these wells and prepare the specifications with a cancellation clause should any of the following phases of construction or testing prove that the wells were not going to be a success.

CONSTRUCTION PHASES:

	<u>Estimated Cost</u>
a. The Water well contractor would drill a rotary 12 or 14 inch hole approximately 400 feet in depth and an electric log would again be taken to assure us to the best ability of the machine that little or no salt water existed. The electric log would be read by two different qualified geologists. X	\$1800.00
b. After this determination, if favorable, the contractor would then construct the 16" diameter casing rotary gravel packed well, and develop, swab and test pump.	\$16,440.00
c. If no salt water was encountered during the test pump or within the 250 ppm permitted by U. S. Public Health, then the contractor would set a pump and electric motor. The City would have the Edison Company install a temporary electrical power service and the City would then pump at the maximum yield of the well for a minimum of 20 to 30 days or longer as required.	\$ 1,000.00
d. If no further encounter of salt existed (within the 250 ppm) and no increase in the salt water content from start to stop of pumping, then the City would hire an expert Ground Water Hydrologist to evaluate and determine the amount of water available from the Santa Monica Basin. At this time, the Ground Water Hydrologist would have the well at X	\$ 600.00

19th and San Vicente, the Arcadia wells, the farmer's well in Venice (if still active), and the Marine St. well to make his estimate.

X
Comment: The Ground Water Hydrologist might well recommend additional wells at Marine Street Park, and/or additional wells along 7th St. from San Vicente Blvd. to Pico Blvd. to capture fresh water that is apparently wasting to the ocean.

- X
e. Pending the results of the first well, recommendation of the Ground Water Hydrologist, and approval of the City, the well contractor would then construct the second well and the observation well. \$19,940.00

Total Cost of Water Wells \$39,780.00

Subject cost does not include pumps, water transmission line, etc. The pumps, etc. could be a budgeted item the following fiscal year.

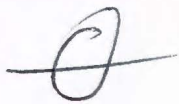
At this time the City would evaluate all results and possibly recommend the construction of a water transmission line to the Arcadia softening plant, and the purchase of all necessary equipment for the wells at Marine Street Park. With the actual wells, pumping results, qualify of water results, and the Ground Water Hydrologist's estimate, the City would be in a better position to recommend the size of the water transmission line, route of the line, and the related equipment for the wells (HP requirement and other misc. equipment).

Financing of the water transmission line would be the largest single expense. The approach to the problem may be:

1. If the water transmission line is not larger than 12 inches in size, the Water Division force account crew could construct the water transmission main, using those funds which would normally be used for the replacement of water distribution mains in the system. This would probably require a two year or more construction period since the Water Division force account would have to answer emergency calls, replace water mains due to street improvement or sewers or storm drains, and water distribution main construction where poor pressure (quantity) or maintenance requires such immediate construction.

2. We visualize that the Manager would recommend to the Council, upon the successful completion of the Marine Street wells or have been given prior authorization, to divert the funds in the Water Division Account 671-924 "Distribution" toward the construction of the subject Marine water well transmission line to the Arcadia softening plant.

If the City policy becomes one of pumping approximately 6 million gallons per day from Charnock, the 1 MG/D presently being pumped from Arcadia and the possibility of a potential 1 MG/D from 19th and San Vicente (total 8 MG/D), the above recommendation may not be as desirable since the total capacity of the softening plant will in all probability not exceed 8 to 8.5 MG/D. The production from the Marine Street wells would then have to be introduced directly into the 250' pressure zone and/or the 350' pressure zone, causing a harder water than City policy might want to authorize. Under this circumstance, it might be possible to mix Marine Street well water with softened water at Arcadia or some other authorized connection within the water system.



The referenced material is entirely too voluminous to reproduce and enclose in the budget; however, they are available in the Water Division office for information of interested individuals.

Geological and Other References:

(1) Water Superintendent's letter dated March 21, 1961, subject: "Comparison of the Composite Water Rate Plan vs. the Separate Water Rate Plan and Recommendation".

(2) United States Department of Interior Geological Survey
Water Supply Paper #1461 entitled, "Geology, Hydrology, and
Chemical Character of Ground Waters in the Torrance-Santa Monica
Area, California".

(3) Report of Referee by Department of Public Works, State
of California, Referee Published 1952. Superior Court in and for
the County of Los Angeles, State of California, No. 506806.

(4) State of California Department of Water Resources Bulletin
No. 63 "Sea Water Intrusion in California".

(5) State of California Department of Water Resources Bulletin
No. 104, Appendix A & B, "Planned Utilization of the Ground Water
Basins of the Coastal Plain of Los Angeles County".

(6) Tentative, "Joint Report on the Ground Water Supply in
Charnock Basin" by City of Santa Monica and Southern California
Water Company

(7) "A Water Exploration as Outlined by the City of Santa
Monica", May, 1965, by United Geophysical Corporation.

(8) "Supplementary Report on Ground Water Geology of the
City of Santa Monica and Proposed Exploration Drilling Program",
by Thomas L. Bailey, Consulting Geologist.

(9) Letter, "Review of United Geophysical Corporation Report and Recommendations on New Well Sites" by Thomas L. Bailey, Consulting Geologist.

(10) Plates 1 through 11 inclusive from the report apparently prepared in 1923 or 1924 by Olmstead & Gillelen for the City of Santa Monica.

(11) "City of Santa Monica Water Division Report on Softening Local Well Water Supply", dated March, 1963, by James M. Montgomery Consulting Engineers, Inc.