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LOS ANGELES DEPARTMENT OF WATER AND POWER
AQUEDUCT DIVISION

MANAGEMENT OF THE SAN FERNANDO VALLEY GROUNDWATER BASIN

DECEMBER 1986

LOS ANGELES DWP DEPARTMENT OF WATER AND POWER

MANAGEMENT OF THE SAN FERNANDO VALLEY GROUNDWATER BASIN

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Introduction

The planning for groundwater management in the San Fernando Valley Basin started more than 75 years ago when this basin was selected for temporary agricultural use of the water to be delivered by the Owens River Aqueduct. It was recognized that the return waters from such uses could be recaptured by the existing City of Los Angeles diversion facilities. In the 1930's, Owens River water was artificially recharged in spreading basins, for later pumping. After more than 100 years of litigation over water rights, the basin adjudication was finally completed in 1979. It was believed that the City of Los Angeles finally had a reliable, secure, long-term water supply in the San Fernando Groundwater Basin. This, however, was not the case. Less than one year after the water rights judgment became final, volatile organic

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Paper presented by Gene Coufal on December 4, 1986 at the National Water Resources Association in San Diego, California.

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contaminants were discovered in large areas of the groundwater basin. This shifted emphasis of activities in the basin to rehabilitation and quality management. This paper discusses some of the early history that established the water rights, the ensuing legal battles, the adjudication, and finally how the contamination problem is being handled.

Geohydrologic Background

The San Fernando Valley Basin (SFVB), otherwise known as ULARA (Upper Los Angeles River Area), is a large alluvial basin of some 122,800 acres lying to the northwest of downtown Los Angeles. The basin is surrounded by hills and mountains. The Los Angeles River in the southeast corner of the basin serves as the regional discharge point for the basin. Ground water in in the San Fernando Basin occurs in the sedimentary deposits that comprise the valley floor. The maximum depth of the alluvium is about 1000 feet and the volume of stored groundwater is about 3 million acre-feet.

The western portion of the San Fernando Valley Basin is generally composed of fine-grained, mostly clayey materials derived from the surrounding hills of sedimentary rocks. The eastern portion of the SFVB generally consists of coarse sand and gravel with minor layers of silts and clays. The eastern deposits are composed of coarse detritus eroded mainly from the granitic basement complex of the San Gabriel Mountains. The valley fill material in the west portion of the SFVB transmits water at a relatively slow rate, whereas valley fill material in the eastern portion transmits

water at a relatively rapid rate. The eastern portion of the basin constitutes about one-third of the surface area of the ground water reservoir and contains approximately two-thirds of the ground water storage capacity of the San Fernando Basin.

The majority of Los Angeles well fields, including the North Hollywood, Crystal Springs, Whitnall, Verdugo, Erwin, and Pollock fields are located in the eastern portion of the San Fernando Basin. In addition to the city of Los Angeles' pumping wells, the cities of Burbank and Glendale also extract large quantities of water from this portion of the basin.

Early History

Under natural conditions, the large underground reservoir beneath San Fernando Valley stored a portion of the intermittent rains which fell on the valley floor, and the runoff which percolated during the winter storms. This underground reservoir regulated these flows and produced perennial rising water at the southeastern outlet of the valley -- the Los Angeles River.

The rare and welcome phenomenon of a stream flowing in the summer was observed by the Spanish Governor of California, Don Gaspar de Portola, on August 2, 1769. The stream was named the Rio de Porciuncula and was recorded as being suitable for supplying water to a mission and a large settlement. Actual settlement came 12 years later, on September 4, 1781, when a small group of 44 people founded El Pueblo la Reina de Los Angeles de Porciuncula. The name of the Pueblo and the river were later shortened to Los Angeles.

With the founding of the Pueblo, there was an understanding under Spanish law that the young settlement had a prior and paramount right to the waters of the river. This meant that, as the Pueblo grew, it could use all of the water it needed, up to the full amount available. The water which it did not need could be used by others so long as the other diversions did not interfere with the needs of the Pueblo. These paramount rights were vigorously defended by the Pueblo and by its successor in interest, the City of Los Angeles, which was incorporated in 1850. Litigation over these rising groundwaters started as early as 1874, when water-gathering activities were exclusively surface diversions, with distribution by gravity to areas of demand.

The Owens River Aqueduct

As the City of Los Angeles grew, so did its water demands. The population was more than 100,000 by 1900. The severe drought of 1895-1904 and the decreasing rising water outflow made it evident that the growing city could no longer depend on its traditional local water supply. A $1.5 million bond issue was passed in 1905 to purchase lands and water rights in the Owens Valley. A much larger bond issue ($25 million) was passed in 1907 to build the Owens River Aqueduct.

Groundwater management in the San Fernando Valley Basin was planned along with the Owens River Aqueduct. To make the aqueduct financially feasible, it was necessary to build it large enough to supply anticipated demands in the future. During the early years of aqueduct operation, it was recognized that there

would be a large surplus of water which could be used for interim agriculture until such time as the growing city would need the water. William Mulholland, under whose leadership the Owens River Aqueduct was conceived and completed, arranged, in 1911, for the appointment of a panel of consulting engineers to study the areas of potential use of the surplus waters and to make a recommendation as to where those waters could be used most effectively. The panel consisted of three eminent civil engineers -- John H. Quinton, William H. Code, and Homer Hamlin. The area of study included most of the coastal plain west to the ocean, all of the San Fernando Valley, the western part of the San Gabriel Valley, and even the more remote eastern part of the San Gabriel Valley. Their report covered such topics as the total supply available (local plus the aqueduct), the needs of the city (both immediate and ultimate), the amount of surplus water available, the topography and soil characteristics of the various areas, and the comparative costs of serving water to those areas. It was contemplated that the area selected for water service would annex to the city. The most compelling reason for the selection of the San Fernando Valley was the early recognition of a concept which later came to be called "conjunctive use".

> "Some of the water used for irrigation is sure to sink deep into the ground, and we estimate that at least one-fourth of all the water used in the San Fernando Valley will eventually return to the Los Angeles River as underflow, and can be utilized a second time. This

water is just as valuable as water direct from the aqueduct" . . . "The San Fernando Valley is the only place were water can be used in territory contiguous to Los Angeles, which admits of the economical handling of return water."

About two years later, on November 5, 1913, Owens River water arrived in Los Angeles, and at the same time the San Fernando Valley was annexed to the city (except for those areas now occupied by the Cities of San Fernando, Glendale, and Burbank). The return water, as expected, augmented the rising water outflow in the Los Angeles River.

There were no important extractions from wells until the mid 1920's, when deep-well turbine pumps became generally available. Water supplies in the Los Angeles River were plentiful until the drought of the late 1920's, when groundwater levels began to drop.

Glendale and Burbank Cases

In 1931, the groundwater spill from the San Fernando Valley ceased, which caused a concern that the paramount right of the City of Los Angeles was being interfered with by the pumping of the Cities of Glendale and Burbank. In 1933, Los Angeles sued Burbank, and in 1936, Los Angeles sued Glendale. Both suits asked for declaratory relief and for an injunction against pumping. Specifically, Los Angeles requested the court to declare that its Pueblo right to native waters was superior to any right claimed by Glendale or Burbank and further, to declare that it had a preferential right to recapture any aqueduct water

that had been artificially recharged to groundwater in spreading basins, or any aqueduct water which, after delivery to customers, had returned (recharged) to the groundwater reservoir.

Start of Spreading

The drought conditions of the late 1920's led to a second phase of groundwater management -- the spreading of aqueduct waters to augment stored groundwater. The Tujunga Spreading Grounds were first used in 1931-32, as well as some gravel pits near the present location of Hansen Dam. Through the dry years of the 1930's, almost 150,000 acre-feet were spread. When conditions turned wet in 1936-37, spreading activities were curtailed. Another wet year and a disastrous flood occurred in 1938. The short trial of the Glendale and Burbank cases was held in 1939. Los Angeles had its rights in the native waters and in the import return waters confirmed, but because of the obvious surplus conditions, the request for an injunction was dropped. The wet period continued through 1944, and was followed by a long drought. Pumping in excess of the safe yield probably started about 1941, but water levels did not start to drop until after 1944. The basin again stopped spilling in 1949. Heavy rains in 1951-52 held promise that the drought had ended, but such was not to be the case. In 1953, the drought resumed.

The San Fernando Case

On September 30, 1955, the City of Los Angeles again sued the Cities of Glendale and Burbank, plus the City of

San Fernando and more than 200 other pumpers in the basin. A reference was made to the State Water Rights Board and the lengthy trial was held in 1966-68. A discussion of this litigation was presented in a previous paper (Mann, 1976). As a milestone in groundwater management, the trial court ruled that the safe yield was about 100,000 acre-feet per year. However, pumping rights were assigned under the doctrine of mutual prescription which had been developed in the Raymond Basin case. The trial judge rejected the concept of the Pueblo right, and the right of Los Angeles to recapture any import return water. The Department of Water Resources was appointed Watermaster to administer the judgment. The trial court decision was appealed and in 1975, the California Supreme Court reversed the trial court judgment and confirmed the Pueblo right to the City of Los Angeles as well as its right to recapture the return water from imports. Glendale and Burbank were also granted the right to recapture the return water from their imports. A short additional trial was held and the judgment became final on January 26, 1979. A new Watermaster was appointed.

The most important element in the management of a groundwater basin is the assignment of the rights to pump. In addition, there are usually provisions which permit the rights formula to function in a practical manner. Several provisions used in the San Fernando Valley Basin are:

1. A fixed percentage of the imported water is considered return water. For Los Angeles, this is 20.8 percent.
2. Water reclaimed from sewage is considered the same as imported water.

3. Physical solution water. Several parties are granted limited rights to water chargeable to the rights of others upon payment of specified charges.

4. Stored water. The four cities have rights to store water in the basin and to extract equivalent amounts.

5. Pumping for nonconsumptive uses such as cooling water.

Watermaster Activities

In addition to overseeing the disposition of water and that the provisions of the Final Judgment are carried out, the ULARA Watermaster prepares a report for each water year (October 1 - September 30), which covers all items of hydrologic interest such as rainfall, total groundwater extractions, amounts of water spread, imports by the City of Los Angeles from the Owens River, imports by The Metropolitan Water District of Southern California from the Colorado River and from the State Water Project, exports (pass through) of Owens River water, exports of groundwater and of sewage, and amounts of reclaimed water. Hydrographs of key wells are updated, and groundwater contour maps are prepared. Calculations are made of annual change of groundwater storage. Stored water credit for each of the four cities is given as of October 1. Surface water outflows are broken down into three categories: rising water; waste discharge; and storm runoff. Recent chemical analyses are tabulated.

Pollution by Volatile Organics

Within a year after the pumping rights had been settled by the January 26, 1979 judgment, 35 of Los Angeles' 80 production wells in the San Fernando Valley were found to contain TCE (trichloroethylene) and PCE (tetrachloroethylene) in concentrations above the action levels set by the California Department of Health Services. The focus of groundwater management has now shifted to groundwater quality management.

In response to the discovery of the volatile organics, the Los Angeles Department of Water and Power through a cooperative agreement with the Southern California Association of Governments applied to the State Water Resources Control Board for EPA funding under the 208 Grant Program to develop a basin-wide Groundwater Quality Management Plan. Other participating cities include Glendale, Burbank, and San Fernando. Funds were received and work began in July 1981. The major objectives of the two-year study were:

1. To define and describe the extent and severity of the present groundwater contamination in the SFVB.
2. To investigate and examine information relative to potential sources of the contamination.
3. To develop and evaluate engineering and regulatory strategies for controlling the contamination problem.
4. To recommend specific programs or actions deemed necessary for the protection and safe use of the basin, including proposed funding alternatives for the implementation of remedial action.

Groundwater Quality Management Plan

A Groundwater Quality Management Plan was completed in July 1983 and presented eight primary recommendations:

1. Public education program.
2. Regulation of private disposal systems -- essentially a complete phase-out of these.
3. Augmented enforcement program.
4. Regulation of storage tanks, sumps, and pipelines.
5. Small-quantity generator hazardous waste disposal program.
6. Regulation of landfills.
7. Groundwater monitoring program.
8. Aquifer management and groundwater treatment.

The first six recommendations involve the prevention of future contamination of the basin through a comprehensive management plan for the handling, storage, and disposal of hazardous materials. Recommendations 7 and 8 involve remedial actions for the current contamination problem, and engineering strategies to allow full use of the groundwater for drinking. Groundwater monitoring to date has been mainly by means of production wells rather than by monitoring wells drilled especially for that purpose. A paper by McReynolds (1985) notes that about 100 SFVB production wells are sampled on a regular basis. The 1984-85 ULARA Watermaster Report shows 47 wells above the action level for TCE and 29 wells above the action level for PCE. The plan is to continue the current monitoring, to expand and coordinate basin-wide monitoring, and to install monitor

wells near potential source areas such as landfills, urban drainage recharge areas, wastewater treatment plants, private disposal systems, storage tanks, sumps, and pipelines.

Recommendation 8 covers operating strategies such as preferential pumping, management of groundwater levels and gradients, blending, removal-treatment-injection, and removal-disposal. One possible method of managing the groundwater quality problems, at least on an interim basis, that is being actively pursued is pumping from the lower portion of the aquifer. This alternative was discussed in detail in a previous paper (Coufal, 1983). A well packer was installed in a well in the North Hollywood area of the San Fernando Valley in an attempt to restrict the vertical movement of ground water containing organic contaminants (TCE and PCE) to the zone above a clay lens where the greatest concentration of contaminants was believed to occur.

The results from the aquifer test and the water quality samples collected while pumping with the packer deflated versus pumping with the packer inflated indicated that water and organic contaminants from the upper zone were effectively prevented from reaching the lower zone and the pump suction. The TCE concentration of the pumped water was reduced from over 100 ppb to approximately 7 ppb. The PCE concentration declined from 4 to 0.5 ppb. The Los Angeles Department of Water and Power (LADWP) is currently having well packers installed in thirteen additional production wells in the San Fernando Valley with expectations of similar results.

In conjunction with the installation of packers in the San Fernando Valley production wells, the LADWP is pursuing the construction of an aeration tower as part of a project to remove TCE and PCE from the groundwater basin in the North Hollywood-Burbank area. The purpose of this project is to determine if this is a feasible method of cleaning-up the aquifer and to help reduce continued rapid spreading of contaminants in the San Fernando Valley groundwater basin. The project calls for the construction of a 45-foot aeration tower with GAC (granular activated carbon) vapor-phase treatment, along with the drilling of approximately 10 shallow wells to supply 2,000 gallons per minute to the tower. LADWP is also investigating a water treatment system using ultraviolet radiation and ozonation to decompose the volatile organics.

Implementation of the eight recommendations of the Groundwater Quality Management Plan is already under way. The Cities of Los Angeles and Glendale, as well as the County of Los Angeles passed ordinances in December 1983 providing for the regulation of underground storage tank construction and monitoring. In March 1984, the Los Angeles City Council adopted a policy to eliminate private sewage disposal systems used by commercial and industrial organizations within the city. An ordinance was enacted in September 1985. New monitor wells have been constructed near several landfills, and monitor wells near several potential large industrial sources are to be installed soon.

As a result of the TCE and PCE problem, four areas of ULARA were put on the U.S. Environmental Protection Agency (EPA) National Priority List in 1984. The four areas are North Hollywood,

Crystal Springs, Glorietta, and Pollock. In March 1986, the LADWP entered into a Cooperative Agreement with the EPA to perform a remedial investigation at the four sites. An amended Cooperative Agreement is currently being prepared by LADWP to incorporate new features of the recently reauthorized Superfund, and to get EPA approval for federal funding of the North Hollywood-Burbank Aeration Facility.

In addition to the above, the ULARA Watermaster's office has also been involved in reviewing reports and making recommendations regarding the handling of groundwater to the Los Angeles Regional Water Quality Control Board in pollution cases involving underground tank leaks at industrial establishments throughout ULARA.

Because the pumping rights have been adjudicated, special arrangements must be made through the Court, under its continuing jurisdiction, for handling these water quality management problems which were not anticipated at the time of the judgment.

Conclusion

After more than 100 years of litigation and almost 70 years of conjunctive use of groundwater and imported water supplies, the water rights in the San Fernando Valley Basin were finally settled on January 26, 1979. That same year, a massive problem of pollution by volatile organics was discovered, ushering in a new era of groundwater management focusing on rehabilitating the groundwaters to potability, and preventing the recurrence of past indiscriminate disposal of hazardous and toxic wastes.

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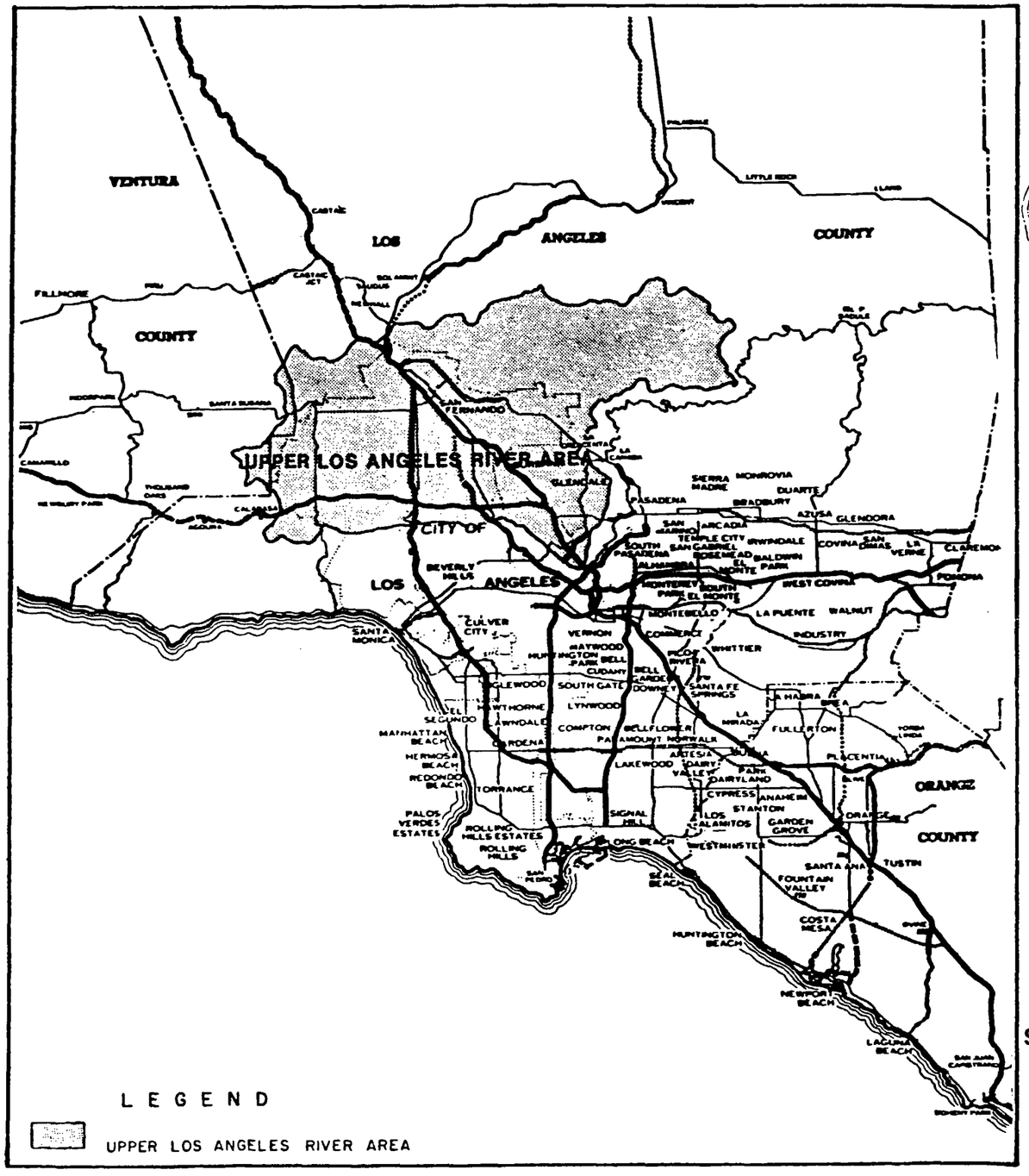
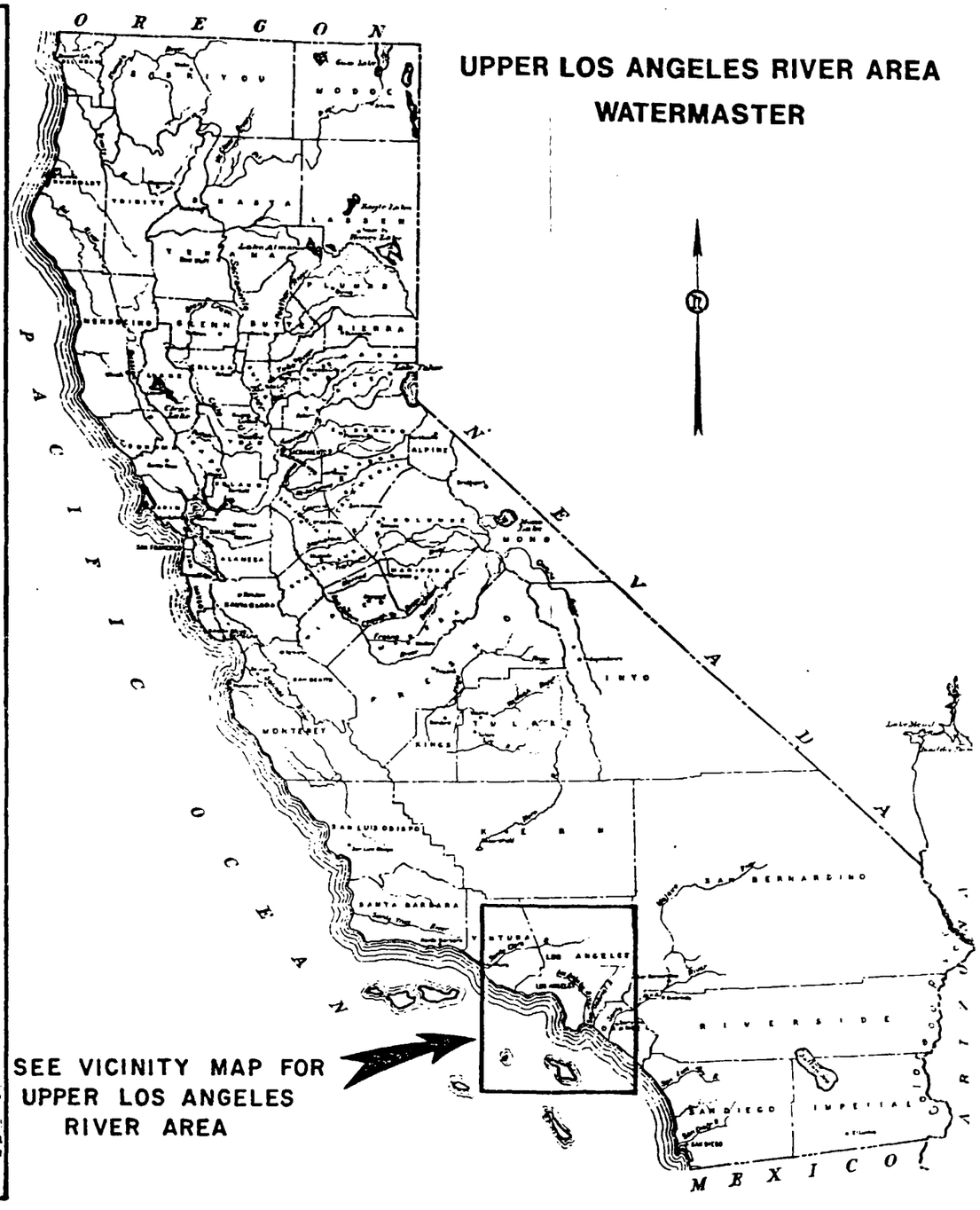
UPPER LOS ANGELES RIVER AREA WATERMASTER



VICINITY MAP

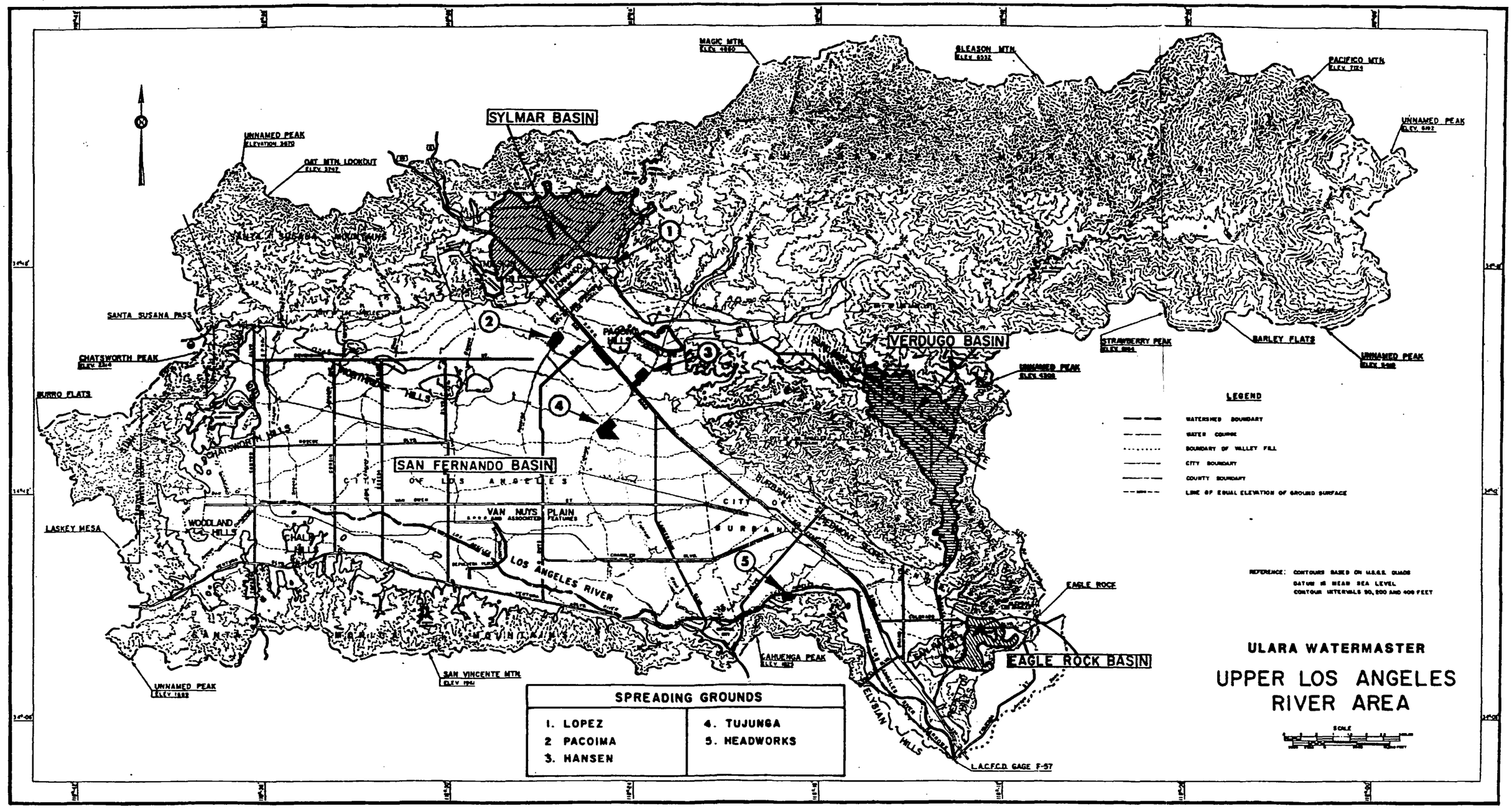
SCALE

0 5 10 15 Miles



LOCATION MAP

PLATE 2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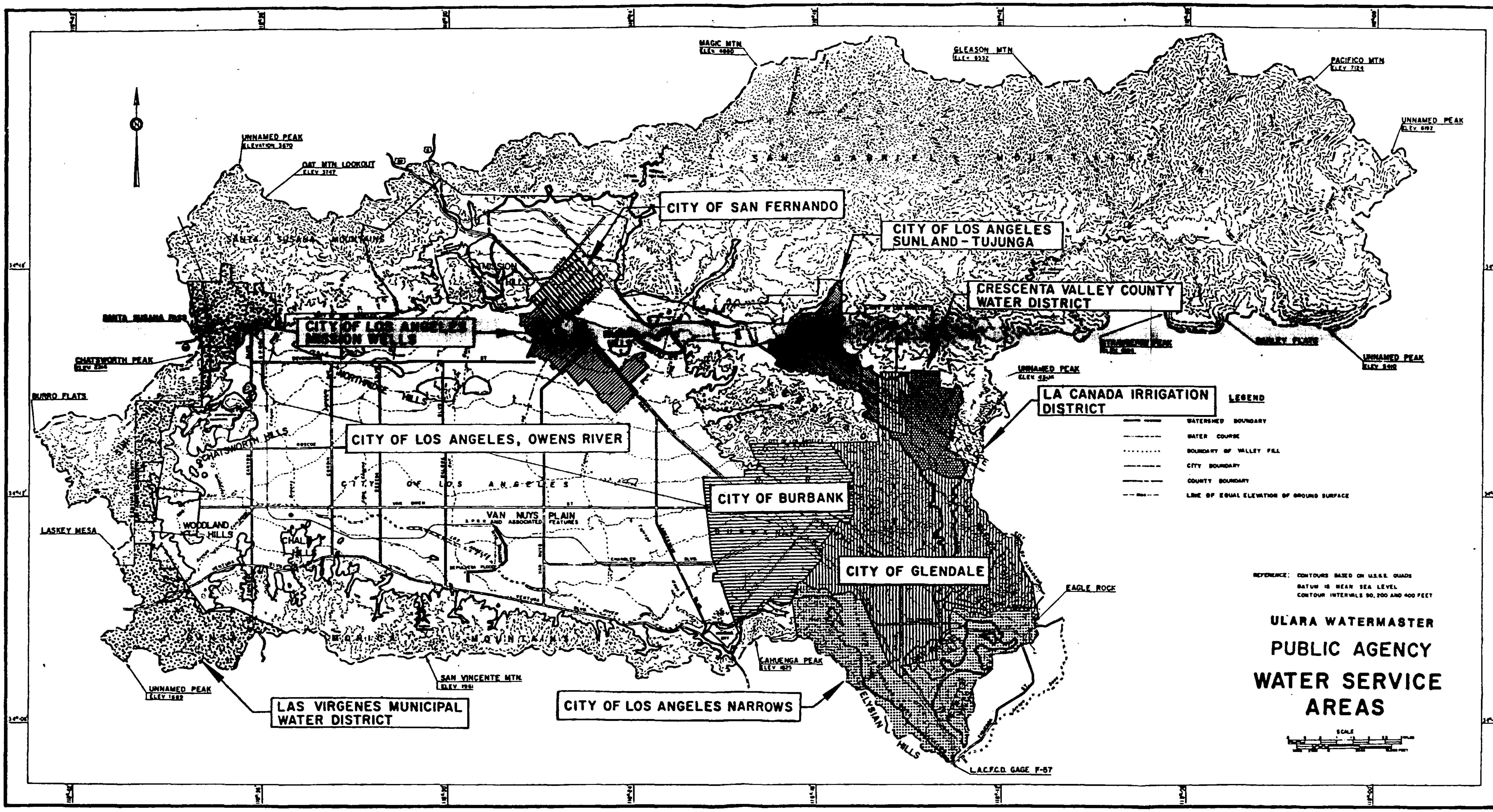
UNNAMED PEAK
ELEV. 6907
SYLMAR BASIN
UNNAMED PEAK
ELEVATION 3870
OAT MTN. LOOKOUT
ELEV. 3747
SANTA SUSANA PASS
CHATSWORTH PEAK
ELEV. 1814
BURRO FLATS
CHATSWORTH HILLS
SAN FERNANDO BASIN
OF LOS ANGELES
VERDUGO BASIN
STRAWBERRY PEAK
ELEV. 6164
BARLEY FLATS
UNNAMED PEAK
ELEV. 5168
UNNAMED PEAK
ELEV. 4368
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL ELEVATION OF GROUND SURFACE
REFERENCE: CONTOURS BASED ON U.S.G.S. DUMOS
DATUM IS MEAN SEA LEVEL
CONTOUR INTERVALS 50, 200 AND 400 FEET
WOODLAND HILLS
LASKEY MESA
VAN NUYS PLAIN
LOS ANGELES RIVER
BURBANK
VERMONT SPRINGS
EAGLE ROCK
EAGLE ROCK BASIN
SAN VINCENTE MTN.
ELEV. 1964
CAHUENGA PEAK
ELYSIAN HILLS
UNNAMED PEAK
ELEV. 1882
L.A.C.F.C.D. GAGE F-57
SPREADING GROUNDS
1. LOPEZ
2. PACOIMA
3. HANSEN
4. TUJUNGA
5. HEADWORKS
ULARA WATERMASTER
UPPER LOS ANGELES RIVER AREA
SCALE

PLATE 3


MAGIC MTN
GLEASON MTN
PACIFICO MTN
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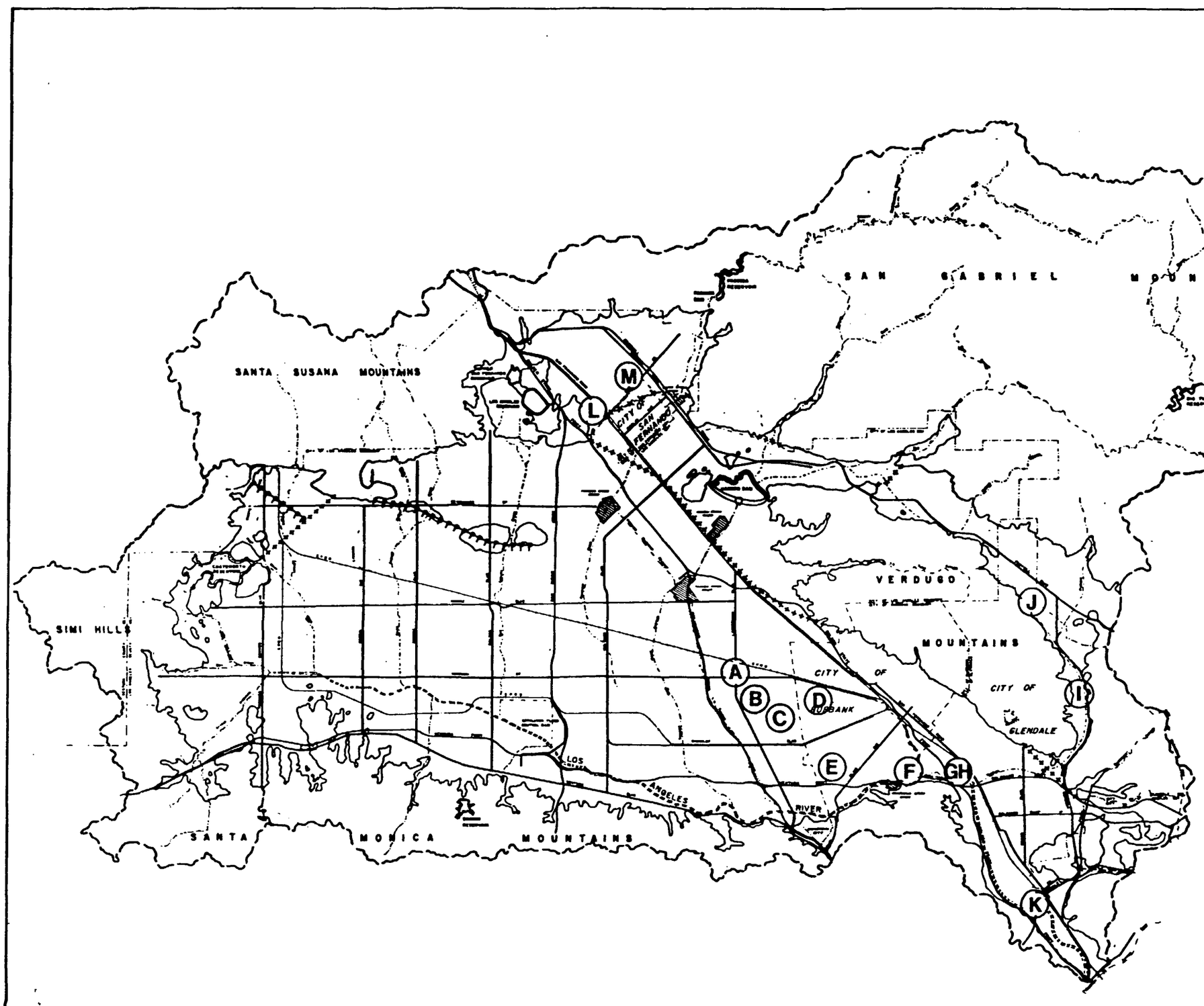
SAN GABRIEL MOUNTAINS
SANTA SUSANA MOUNTAINS
CITY OF SAN FERNANDO
CITY OF LOS ANGELES SUNLAND - TUJUNGA
CRESCENTA VALLEY COUNTY WATER DISTRICT
CITY OF LOS ANGELES MISSION WELLS
MISSION HILLS
CHATSWORTH PEAK
BURRO PLATS
LA CANADA IRRIGATION DISTRICT
CITY OF LOS ANGELES, OWENS RIVER
CHATSWORTH HILLS
CITY OF LOS ANGELES
CITY OF BURBANK
VAN NUYS PLAIN
WOODLAND HILLS
LASKEY MESA
CITY OF GLENDALE
EAGLE ROCK
SAN VINCENTE MTN
CAHUENGA PEAK
LAS VIRGENES MUNICIPAL WATER DISTRICT
CITY OF LOS ANGELES NARROWS
ELYSIAN HILLS
L.A.C.F.C.D. GAGE F-57
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL ELEVATION OF GROUND SURFACE
ULARA WATERMASTER
PUBLIC AGENCY
WATER SERVICE
AREAS
SCALE



ULARA WATERMASTER

UPPER LOS ANGELES RIVER AREA

WELL FIELD LOCATIONS

A - NORTH HOLLYWOOD
B - ERWIN
C - WHITNALL
D - CITY OF BURBANK
E - VERDUGO
F - HEADWORKS
G - CRYSTAL SPRINGS
H - CITY OF GLENDALE (GRANDVIEW)
I - CITY OF GLENDALE (GLORIETTA)
J - C.V.C.W.D.
K - POLLOCK
L - MISSION
M - CITY OF SAN FERNANDO